

Comparison of Plasma Cardiac Troponin I and Cardiac Enzymes in Haemodialysis Patients of Gorgan (South East of Iran)

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Abstract: The objectives of this study were to evaluate the effect of haemodialysis on plasma Cardiac Troponin I and cardiac enzymes before and after the dialysis process. Twenty two patients with Chronic Renal Failure (CRF) disease who were haemodialyzed at 5th Azar hospital of Gorgan Dialysis Center were recruited for this study (2005). The patients do not have coronary heart disease. Plasma cardiac enzymes showed no significant difference in the post dialysis group when compared with predialysis. Plasma levels of Cardiac Troponin I in 12 haemodialyzed patients were significantly increased in the postdialysis group when compared with predialysis, whereas plasma level of Cardiac Troponin I in 10 haemodialyzed patients were undetectable (less than $0.1 \mu\text{g L}^{-1}$). The observation of meaningful increasing level of plasma Cardiac Troponin I in the haemodialyzed patients after the process of dialysis shows that Cardiac Troponin I is highly specific marker for Acute Myocardial Infarction (AMI) when compared with other cardiac enzymes and is particularly useful for detecting AMI in chronic renal failure and haemodialysis patients which can prevent sudden cardiovascular abnormality and sudden silent myocardial infarction in these patients

Key words: Haemodialysis, cardiac enzymes, cardiac Troponin I

INTRODUCTION

Cardiovascular disease is one of the leading cause of death in chronic renal failure patients on dialysis, as well as leading cause morbidity (Raine *et al.*, 1992). Clinical and subclinical myocardial ischaemia are common among chronic renal failure patients, both before and during dialysis (Foley *et al.*, 1995; Singh *et al.*, 1994). Earlier detection of cardiovascular abnormality in these patients might allow earlier interventions to reduce morbidity and mortality. The prevalence of ischemic heart disease in haemodialysis patients is 10-20 times higher than that in the general population with 50% mortality due to Cardiovascular disease. According to the US Renal Data System 42% of patients undergoing haemodialysis have had a myocardial infarction or Coronary revascularization. In addition, the rate of survival after myocardial infarction is much lower for haemodialysis patients than for the general population (Heeschen *et al.*, 2000). Several markers should be used to evaluate Cardiac disease. These include total creatine Phosphokinase (CPK), Aspartate aminotransferase (AST) and total Lactate dehydrogenase (LDH). These markers have poor specificity for early detection of Cardiac injury because of their wide

tissue distribution. In recent years, new marker of myocardial injury has been introduced into clinical practice. Cardiac Troponin I is specific marker of myocardial damage (Bodor *et al.*, 1992; Coudry, 1998). Patients with chronic renal failure undergoing haemodialysis have a high incidence of Cardiac events (Foley *et al.*, 1995) and of false-positive increases in myoglobin as well as creatine kinase-MB isoenzymes (Jaffe *et al.*, 1984; Pierce and Jaffe, 1986). Cardiac Troponin I may be increased in these patients without evidence of ischemic myocardial damage (McLaurin *et al.*, 1997). In haemodialysis patients, the clinical symptoms of Cardiac damage are difficult to diagnosis and may be deceptive. In addition, high serum concentrations of myoglobin and creatine kinase-MB lack specificity (Jaffe *et al.*, 1984). In recent years, Cardiac Troponin I has been increasingly used in the diagnosis of acute coronary syndromes as studies have shown their greater clinical sensitivity over creatine kinase-MB (Costa *et al.*, 1997).

The aim of this study with the discriminative information was to evaluate the effect of haemodialysis on plasma Cardiac enzymes (total creatine Phosphokinase (CPK), Aspartate aminotransferase (AST) and total Lactate dehydrogenase (LDH)) and Cardiac Troponin I

before and after the dialysis process, to find out the effect of haemodialysis on the plasma Cardiac enzymes and Cardiac Troponin I.

MATERIALS AND METHODS

Twenty two haemodialysis patients who had no clinical evidence of myocardial ischaemia, with average age 43.54±9.21 years of old (range 21-55). The mean length of dialysis for each patients was 3.95±0.14 h with average 2.27±0.45 times a week. Patients were chosen (14 male, 8 female) from the patients referred to the Department of Haemodialysis Center at 5th Azar hospital in Gorgan University of Medical Sciences (2005). The patients studied had no evidence of vascular complications, including hypertension, coronary artery disease.

Blood samples were obtained from the patients just before and after the process of dialysis in a heparinized tubes. Plasma is separated as soon as the blood taken. The plasma urea, creatinine, total creatine Phosphokinase (CPK), Aspartate aminotransferase (AST) and total Lactate dehydrogenase (LDH) were determined for haemodialyzed patients before and after the dialysis process, using laboratory kit spectrophotometry technique (model JENWAY 6105 UV/VIS) in the laboratory of Biochemistry (Faculty of Medicine). Plasma Cardiac Troponin I was determined on the VIDAS instrument (made in FRANCE) using the ELFA (Enzyme-Linked Fluorescent Assay) technique (Adams *et al.*, 1993).

Data was analyzed by student's t- test using SPSS-11.5 software. p-value less than 0.05 was considered significant.

RESULTS

In present study we determined the plasma levels of total Creatine Phosphokinase (CPK), Aspartate aminotransferase (AST) and total Lactate dehydrogenase (LDH) and Cardiac Troponin I in 22 patients with Chronic Renal Failure. As shown in Table 1 plasma levels of CPK, AST and LDH showed no significant difference in the postdialysis group when compared with predialysis.

Plasma level of Cardiac Troponin I (in 12 haemodialyzed patients) were significantly increased after the dialysis process when compared with the predialysis (p<0.001).

The plasma levels of Cardiac Troponin I in 12 haemodialyzed patients were significantly increased before the dialysis process when compared with normal range (p<0.001). The plasma levels of Cardiac Troponin I in 10 haemodialyzed patients were undetectable (less than 0.1 µg L⁻¹). The ranges of >0.1 - <0.8 µg L⁻¹ show possible myocardial damage. The ranges of >0.8 µg L⁻¹ show acute myocardial Infarction Cut-off.

DISCUSSION

The aim of the present study was to determine and compare the plasma level of Cardiac enzymes (CPK, AST, LDH) and Cardiac Troponin I in predicting the outcome of haemodialysis patients on regular dialysis. There are a few reports describing difference in plasma Cardiac enzymes and Cardiac Troponin I in haemodialyzed patients. Some of the studies showed an increase while some other showed a decrease or no significant differences. The results of this study show that the plasma level of CPK, AST, LDH no significant differences in postdialysis group when compared with predialysis group and Cardiac Troponin I was significantly increased in postdialysis group when compared with predialysis group.

Andersen (1980) was studied serum enzyme levels (CPK, AST, LDH) in dialysis patients. The enzyme levels were within normal range.

Study of Singhal *et al.* (1988) on 105 haemodialysis patients showed that plasma level of CPK in 30 haemodialysis patients increased.

Study of Nakai *et al.* (2004) on 61 haemodialysis patients showed that plasma level of CPK in 4 haemodialysis patients increased.

Study of Chimata *et al.* (1994) on 150 haemodialysis patients showed that plasma level of AST in 14 haemodialysis patients decreased.

In this study we determined the level of plasma CPK, AST, LDH of haemodialysis patients before and after the dialysis process .Our results show no significant differences of plasma CPK, AST, LDH in the postdialysis

Table 1: The mean and standard deviation of plasma urea, creatinine, total creatine phosphokinase, aspartate aminotransferase total lactate dehydrogenase and cardiac Troponin I

Test	Predialysis	Postdialysis	p-value
Urea (mg dL ⁻¹)	123.54±8.51	55.68±7.96	*<0.001
Creatinine (mg dL ⁻¹)	15.88±3.07	1.96±0.45	*<0.001
Total creatine phosphokinase (U L ⁻¹)	44.33±1.56	43.78±1.27	>0.001
Total Lactate dehydrogenase (B-BU mL ⁻¹)	182.95±7.24	180.68±10.01	>0.001
Aspartate aminotransferase (U L ⁻¹)	33.18±4.20	32.86±2.39	>0.001
Cardiac Troponin I (n =12) (µg L ⁻¹)	0.21± 0.040	0.57± 0.09	*<0.001

*p-value was significant

group when compared with the predialysis group. Present results are in agreement with the groups mentioned in that the plasma level of CPK, AST, LDH of haemodialysis patients show no significant difference (Andersen, 1980). But the results of this study are not in agreement with the results of Singhal *et al.* (1988) and Nakai *et al.* (2004) showing plasma level of CPK in haemodialyzed patients were significantly increased after the dialysis process. The results of this study also are not in agreement with the results of Chimata *et al.* (1994) showing plasma level of AST in haemodialyzed patients were significantly decreased. This situation probably in due to direct relation between the blood of haemodialysis patients with dialysis instrument or reaction of enzymes with some uremic substances.

There are a few studies describing difference in plasma Cardiac Troponin I in haemodialyzed patients without myocardial ischaemia symptoms. The diagnosis of myocardial ischaemia is difficult in haemodialysis patients since they are not able to perform adequate exercise tests due to limited exercise tolerance. Therefore the use of reliable biochemical marker for the detection of myocardial damage is essential in these patients (Tun *et al.*, 1998). Some studies showed that the level of Cardiac Troponin I increased in haemodialyzed patients without myocardial ischaemia symptoms (Adams *et al.*, 1993; Khan *et al.*, 2001; Beciani *et al.*, 2003; Ziebig *et al.*, 2003). Some other studies reported that the level of Cardiac Troponin I show no significant differences before and after the dialysis process in haemodialyzed patients (Tun *et al.*, 1998; Donnino *et al.*, 2004). Study of Vayand *et al.* (2000) showed that the plasma level of Cardiac Troponin I increased in haemodialyzed patients without myocardial ischaemia symptoms. Present results are in agreement with the results of studies showing that the plasma level of Cardiac Troponin I increased in haemodialyzed patients (12 haemodialyzed patients) after the dialysis process (Adams *et al.*, 1993; Khan *et al.*, 2001; Beciani *et al.*, 2003; Ziebig *et al.*, 2003). But the results of this study are not in agreement showing that the plasma level of Cardiac Troponin I in haemodialyzed patients decreased (Vayand *et al.*, 2000) or showed no significant differences (Tun *et al.*, 1998; Donnino *et al.*, 2004) after the dialysis process.

The observation of meaningful increasing level of plasma Cardiac Troponin I in the haemodialyzed patients after the process of dialysis shows that Cardiac Troponin I is highly specific marker for Acute Myocardial Infarction (AMI) when compared with other cardiac enzymes and is particularly useful for detecting AMI in chronic renal

failure and haemodialysis patients which can prevent sudden cardiovascular abnormality and sudden silent myocardial infarction in these patients.

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