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Research Article

Evaluation of insulin and C-peptide in diabetic patients undergoing renal dialysis

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ABSTRACT

Background: Patients with kidney failure associated with diabetes mellitus have disturbed responses of several glucoregulatory hormones. Diabetic nephropathy is the leading cause of end stage renal disease (ESRD). Renal failure is the progressive loss of function of kidney and patient requires a long renal replacement therapy, during which body's waste products including urea, creatinine, glucoregulatory hormones and excess water are removed. Objectives of the study were to evaluate insulin and c-peptide concentrations in diabetic patients on renal dialysis and to compare the concentration of insulin, c-peptide, random blood glucose, urea and creatinine in pre and post dialysis samples of both controlled and uncontrolled diabetic patients.
Methods: The study was conducted in 30 patients with diabetic kidney disease undergoing renal dialysis. The patients were grouped as controlled diabetics and uncontrolled diabetics based on their HbA1c levels. Pre and post dialysis blood samples were collected from patients. Concentration of insulin and c-peptide were analyzed by using ELISA methods. Random blood glucose (RBG), urea and creatinine were estimated by standard methods.
Results: The patients were divided into 2 groups depending on their HbA1c levels as controlled and uncontrolled diabetes mellitus. The concentration of insulin, c-peptide, RBG, serum urea and creatinine showed statistically significant reduction in post dialysis samples when compared to pre dialysis in uncontrolled diabetics. But in case of controlled diabetes mellitus reduction was observed in the levels of insulin and c- peptide in post dialysis samples as compared to pre dialysis samples, but, the difference was not statistically significant.
Conclusions: There are alterations in the levels of insulin, c-peptide and the glycemic status in diabetic patients during dialysis. This significant reduction may affect glucose metabolism in diabetic patients on dialysis. Hence, glycemic status should be continuously monitored in these patients.

Keywords: Diabetes mellitus, Insulin, C-peptide

INTRODUCTION

Statistical analysis of diabetes worldwide shows 2.8% prevalence in 2000 and approximate 4.4% by 2030.[1] Diabetes in 2000 was around 171 million which is expected to rise to 366 million by 2030.[1] In the past 30 years diabetes has soared in urban (12-18%) and rural (3-6%) India.[2] In the pathogenesis of type I diabetes mellitus, viral infection, genetic predisposition and autoimmunity have been implicated, which requires lifelong treatment with exogenous insulin for survival.[3,4] On the other hand, increasing proportion of the sedentary life style, aging population, obesity and consumption of calorie rich diet have led to a tremendous increase in type II diabetes.[5]

The major root cause of chronic kidney disease culminating in end stage renal disease or dialysis is

diabetic nephropathy.[6] Uncontrolled hypertension/ hypertension is the leading cause of diabetic nephropathy which is marked by proteinuria and progressive renal failure. The mortality and morbidity rates are higher in transplant recipients and diabetic patients on dialysis than their non-diabetic counterparts.[7]

Glucometabolic disturbances are frequent pathological findings in patient with end stage renal disease, which is also encountered in non-diabetic patients with ESRD. Thus elevated fasting concentration and abnormal postprandial responses of glucoregulatory peptide hormones such as insulin, glucagon and two gut incretin hormones, glucagon like peptide-1 and glucose dependent insulinotropic polypeptide have been observed in nondiabetic dialysis treated ESRD patients.[8,9] Plasma insulin and c-peptide are cleared during hemodialysis. Their clearance rate and reduction rates depends on type of dialysis membrane and patients following diabetic medications.

METHODS

The study was carried out at Jubilee Mission Medical College and Research Institute, Thrissur. Thirty patients diagnosed with diabetic kidney disease and undergoing renal dialysis in the Nephrology Department of Jubilee Mission Medical College and Research Institute were included in this study. Informed written consent was obtained from all patients and data were collected by preparing questionnaire. Ethical clearance was obtained from Institutional Ethics Committee. Diabetic patients with chronic kidney disease on regular hemodialysis were included in the study, while patients without diabetes on hemodialysis and with infectious diseases were excluded. Insulin was measured using ELISA technique. C-peptide was measured using DRGBC-peptide ELISA kit. Estimations of serum glucose, urea and creatinine were done by standard methods. HbA1c was measured by immunoturbidimetry.

RESULTS

The results presented are from serum samples of diabetic kidney disease patients before and after hemodialysis. HbA1c values less than 8.0 % is considered appropriate glycemic control in diabetic patients having complications such as chronic kidney disease, nerve problems or cardiovascular disease.[10] The patients were grouped into two based on their HbA1c levels (Table 1).

- Group 1: Patients with controlled diabetes mellitus on haemodialysis
- Group 2: Patients with uncontrolled diabetes mellitus on haemodialysis.

Table 1: Distribution of diabetic patients on haemodialysis.

Group	Age	Male	Female	Total
Group I controlled diabetics (HbA1c < 8.0%)	47-65	15	1	16
Group II uncontrolled diabetics (HbA1c >8.0%)	41-75	11	3	14

Parameters analyzed were creatinine, urea, random blood glucose, insulin and c-peptide in pre and post dialysis samples. The values obtained for serum parameters in pre and post dialysis controlled diabetic patients are represented in Table 2.

Table 2: Concentration of random blood glucose, urea, creatinine, insulin and c-peptide in controlled diabetic patients on haemodialysis (HbA1c < 8.0%).

Parameters	Insulin (µIU/ml)	C-peptide (ng/dl)	Random blood glucose (mg/dl)	Urea (mg/dl)	Creatinine (mg/dl)
Predialysis	15.33±8.45	5.3±1.7	150.1±22	153.6±24.5	9.22±1.6
Post dialysis	11.32±4.9	4.6±2.0	134±19.8	78±10.05	3.8±0.54
Level of significance	NS	NS	NS	p<0.05	p<0.05

Table 3: Concentration of random blood glucose, urea, creatinine, insulin and c-peptide in Uncontrolled diabetic patients on haemodialysis (HbA1c > 8.0%).

Parameters	Insulin (µIU/ml)	C-peptide (ng/dl)	Random blood glucose Mg/dl.)	Urea (mg/dl)	Creatinine (mg/dl)
Predialysis	11.60±3.8	3.1±1.4	253.9±88.9	168.9±49.6	10.7±2.5
Post dialysis	6.7±1.6	2.4±1.2	154±28.7	72.4±13.9	4.7±1.03
Level of significance	p<0.05	p<0.05	p<0.05	p<0.05	p<0.05

The values obtained for serum parameters in pre and post dialysis uncontrolled diabetic patients are represented in Table 3.

DISCUSSION

Previous studies revealed variations in the clearance of insulin during dialysis while using different dialyzer membranes.[11-13]

It was established by Abe et al that polysulphone membranes has high insulin clearance.[11] He also inferred that adsorption of insulin to filters was the cause of removal as no insulin was revealed in the utilized dialysate. On the contrary, Morten B Jorgensen et al detected the presence of insulin in all dialysate samples.[14]

This disparity in results can be explained by either permeability of dialyzer membrane and matrix interference or relative slow blood flow. Moreover, the capacity of proteins to adsorb is determined by hydrophilic/ hydrophobic and electrochemical properties, which in turn is influenced by the composition of membranes (polysulphone, polyvidone and polyamide polymers). Evaluation of the variations in the clearance of insulin and c-peptide of diabetic patients on hemodialysis in relation to the glycemic control of diabetes is considered important to understand the effect of dialysis on the glycemic status.

In the present study we observed that insulin and c-peptide levels were decreased in post dialysis samples as compared to pre dialysis samples in controlled diabetic patients. But, the reduction was not statistically significant. On the other hand, statistically significant reduction was observed in the glucose, insulin and c-peptide levels in post hemodialysis samples when compared with those in pre dialysis samples in uncontrolled diabetic patients.

Various authors observed that dialysis would interfere with glucose homeostasis and good glycemic control results in better survival of ESRD.[15,16] The high variability in the clearance of insulin and c-peptide in the controlled and uncontrolled diabetic groups could be attributed to the flow rate of blood through the dialysis membrane.

CONCLUSION

In the present study alterations in the glycemic status, insulin and c-peptide levels have been observed in patients undergoing haemodialysis. Hence, the glycemic status should be continuously monitored in the diabetic patients undergoing renal dialysis even during non-hemodialysis period.

As far as possible, good glycemic control should be achieved in haemodialysis patients, as controlled diabetics did not show statistically significant difference in glucoregulation during dialysis.

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REFERENCES

1. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes for the year 2000 and projections for 2030. Diabetes Care. 2004;27(5):1047-53.
2. Ramachandran A, Mary S, Yamuna A, Murugesan N, Snehalatha C. High prevalence of diabetes and cardiovascular risk factors associated with urbanization in India. Diabetes Care. 2008;31(5):893-8.
3. Muthukrishnan J, Kiranmayi L, Verma A, Modi KD. Type I diabetes mellitus: Correlation between etiological factors and associated conditions. Int J Diab Dev Ctries. 2007;27(2):46-9.
4. Mehra VK, Kumar N, Kaur G, Kanga U, Tandon N. Biomarkers of susceptibility to type I diabetes with special reference to Indian population. Ind J Med Res. 2007;125(3):321-5.
5. El-Shenawy NS, Abe-Nabi IM. Hypoglycemic effect of Cleome Dreserifolia ethanolic leaf extracts in experimental diabetes, and on non-enzymatic antioxidant, glycogen thyroid hormone and insulin levels. Diabetologia Croatica. 2006;35(1):15-22.
6. Zhang LZ, Xu Z, Pronyuk K, Chen X, Hairong WG. Diabetic nephropathy: Causative and protective factors. Global J Med. Res. 2015;15(2):17-26.
7. US Renal Data System. USRDS 2002 Annual data report: Atlas of ESRD in the US, National Institute of Health-National Institute of Diabetes and digestive and kidney disease, Bethesda, md. 2002.
8. Idorn T, Knop FK, Jorgensen M, Holst J, Hornum M, Feldt-Rasmessen B. Postprandial responses of incretin and pancreatic hormones in non-diabetic patients with end stage renal disease. Nephrol. Dial. Transplant. 2014;29(1):119-27.
9. Lindgren O, Carr RD, Deacon CF, Holst JJ, Pacini G, Mari A, et al. Incretin hormone and insulin responses to oral versus intravenous lipid administration in humans. J Clin Endocrinol Metab. 2011;96:2519-24.
10. NIH: National Institute of Diabetes and Digestive and Kidney diseases; Diagnosis of diabetes and prediabetes. Available at: www.diabetes.niddk.nih.gov
11. Abe M, Kaizu K, Matsumoto K. Plasma insulin is removed by hemodialysis: evaluation of the relation between plasma insulin and glucose by using a dialysate with or without glucose. Ther Apher Dial. 2007;11:280-7.
12. Corvilain J, Brauman H, Delcroix C, Toussaint C, Vereerstraeten P, Franckson JR. Labeled insulin

catabolism in chronic renal failure and in the anephric state. Diabetes. 1971;20:467-75.
13. Orskov C, Rabenhøj L, Wettergren A, Kofod H, Holst JJ. Tissue and plasma concentrations of amidated and glycine-extended glucagon-like peptide I in humans. Diabetes. 1994;43:535-9.
14. Jorgensen MB, Idorn T, Knop FK, Holst JJ, Hornum M. Feldt-Rasmussen B. Clearance of glucoregulatory peptide hormones during haemodialysis in non-diabetic end-stage renal disease patients. Nephrology Dialysis Transplantation. 2015;30(3):513-20.
15. Park J, Lertdumrongluk P, Molnar MZ, Kovesdy CP, Kalnta-Zadeh K. Glycemic control in diabetic dialysis patients and the burn-out diabetes phenomenon Current Diabetes Reports. 2012;12(4)432 -9.
16. Morioka T, Emoto M, Tabata T, Shoji T, Tahara H, Kishimoto H, et al. Glycemic control is a predictor of survival for diabetic patients on dialysis. Diabetes Care. 2001;24(5):909-13.

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