Original Article

DOI: 10.7860/JCDR/2014/10404.5306

Biochemistry Section

Correlation of Serum and Salivary Biochemical Parameters in end Stage Renal Disease Patients Undergoing Hemodialysis in Pre and Post-Dialysis State

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ABSTRACT

Aim: The aim of this study is to compare the salivary urea, creatine, sodium, potassium and phosphate in pre dialysis and post dialysis state in end stage renal disease patients and compare with the serum counterpart.

Materials and Methods: The study group was selected from patients undergoing hemodialysis due renal failure of any cause, who are undergoing dialysis for at least one year duration in a private hospital in Chennai. The total number of subjects was 30. The venous blood was collected from the study group just prior to the dialysis and after the dialysis from the venous catheter which is placed for the purpose of hemodialysis. The collected samples were immediately (within 15 min) submitted to the laboratory for the biochemical examination of urea, creatinine, sodium, potassium and phosphate by an automated biochemical analyser. Unstimulated whole saliva was collected by spitting method from study group both before and after dialysis. The collected samples were immediately submitted to the laboratory for the biochemical examination of urea, creatinine, sodium, potassium and phosphate by an automated biochemical analyser.

Result: The paired t-test analysis was done in pre and post blood urea, creatinine, potassium and phosphate which was significant with a p-value of < 0.0001 and the same analysis was done in salivary urea in pre and post-dialysis state which also gave a significant reduction in the parameters with a p-value of < 0.0001.

Keywords: Biochemical analysis, End stage renal disease, Kidney disease, Salivary diagnostics

INTRODUCTION

Chronic renal failure is defined as the progressive and usually irreversible decline of the glomerular filtration rate, leading to an increase of serum creatinine and blood urea nitrogen levels. The most frequent causes of chronic renal failure are hypertension, diabetes mellitus, chronic glomerulonephritis, uropathy and autoimmune diseases [1]. Because of its usual irreversible and progressive nature, the evolution to the end stage renal disease (ESRD) occurs where glomerular filtration rate is around 5-10% and there is a high level of uremia. Most of the signs and symptoms of the disease reflect this biochemical changes in the blood [1].

Saliva has hundreds of components that may serve to detect systemic diseases or as evidence of exposure to various harmful substances, as well as provide biomarkers of health and disease status. Nowadays, the saliva research field is rapidly advancing due to the use of novel approaches including metabolomics, genomics, proteomics and bioinformatics [2]. With the aim of deriving multiple markers in the saliva as a diagnostic tool, we selected end stage renal disease as suitable disease state, because its effect on blood composition is a well known factor. Owing to the contribution of serum-derived components to whole saliva, we hypothesized that changes in serum composition caused by hemodialysis would be reflected in saliva.

MATERIALS AND METHODS

This study was conducted in the year 2011, in a private hospital in Chennai where the study group was selected from patients undergoing hemodialysis for at least one year duration and who are above 20 y of age with a mean age of 50.33y including, both males and females in almost equal ratio 16 males and 14 females with a total of 30 patients. The exclusion criteria was, the duration of the disease was not standardized within certain limits, all patients above one year duration of ESRD was taken for the study and also the medication which the patients consuming was not altered during the study period and also with no other systemic illness other than renal failure with a cause of diabetes and hypertension. Thirty end stage renal disease patients were selected from whom the venous blood was collected from the venous catheter prior to and after the dialysis procedure with informed consent. Unstimulated whole saliva of about 5ml using spitting method was also collected in the same time in a sterilized container. Both the samples were processed immediately (within 15 min) to evaluate the serum and salivary urea, creatinine, sodium, potassium and phosphate using the automatic analyser(colorimetric method). Both the samples were evaluated and statistically analysed using paired t-test analysis.

RESULTS

The mean age value for the study group is 50.33 y, with almost equal gender distribution (16 males and 14 females). The mean values of pre and post blood urea, creatinine, sodium, potassium and phosphate is given in the [Table/Fig-1] respectively. The mean values of pre and post salivary urea, creatinine, sodium, potassium and phosphate are given in the [Table/Fig-2] respectively.

The paired t-test analysis was done in pre and post-blood urea, creatinine, potassium and phosphate which was significant with a p-value of < 0.0001 and the same analysis was done in salivary urea in pre and post dialysis state which also gave a significant reduction in the parameters with a p-value of < 0.0001. The values were not significant for both serum and salivary sodium levels.

	n	Mean±SD	p-value
Pre D Blood U	30	132.34±32.81	<0.001
Post D Blood U	30	51.20±16.19	
Pre D Blood C	30	8.68±2.77	<0.001
Post D Blood C	30	4.12±1.48	
Pre D Blood Na	30	133.50±4.75	0.071
Post D Blood Na	30	135.23±4.38	
Pre D Blood K	30	5.73±1.24	<0.001
Post D Blood K	30	3.72±0.75	
Pre D Blood PO_4	30	6.3±1.90	0.004
Post D Blood PO_4	30	6.01±1.92	

[Table/Fig-1]: Mean value of pre and post dialysis blood samples for serum urea, creatinine, sodium, potassium and phosphate and their p-values, *Pre D - Pre Dialysis, Post D – Post Dialysis, U – Urea, C – Creatinine, Na – Sodium, K – Potassium, PO_4 – Phosphate*

	n	Mean±SD	p-value
Pre D Saliva U	30	95.21±30	33.48
Post D Saliva U	30	40.43±15.75	
Pre D Saliva C	30	0.890±0.476	0.005
Post D Saliva C	30	0.639±0.340	
Pre D Saliva Na	30	126.33±6.35	0.384
Post D Saliva Na	30	126.97±6.07	
Pre D Saliva K	30	4.45±1.61	<0.001
Post D Saliva K	30	3.58±1.30	
Pre D Saliva PO_4	30	21.10±7.99	0.005
Post D Saliva PO_4	30	19.09±7.61	

[Table/Fig-2]: Mean value of pre and post dialysis salivary samples for serum urea, creatinine, sodium, potassium and phosphate and their p-values, *Pre Dialysis, Post D – Post Dialysis, U – Urea, C – Creatinine, Na – Sodium, K – Potassium, PO_4 – Phosphate*

DISCUSSION

Renal diseases are life threatening in nature next to cardiovascular diseases. Most common renal diseases are acute renal failure, acute nephritic syndrome, glomerular nephritis, intestinal nephritis, and nephrogenic diabetes insipidus. All the above mentioned renal disorder may lead to chronic renal failure [3]. Renal excretory function can be assessed by measuring serum levels of compounds excreted by the kidney, commonly the products of protein catabolism (urea and creatinine) and since kidney acts to maintain the constancy of body fluids, by adjusting urine volume and composition, the level of serum electrolytes such as sodium, potassium and phosphate are also measured as an investigatory tool for diagnosis of renal disease.

Whole saliva is a mixed oral fluid derived from the major and minor salivary glands. In addition, saliva contains constituents of non salivary origin, including a variety of microorganisms and their products, blood cells, desquamated epithelial cells, and food debris. Saliva also contains serum-derived components resulting from passive diffusion via gingival crevices; therefore, saliva has been proposed to be a good surrogate of blood for diagnostic purposes. Furthermore, saliva can be collected noninvasively and more easily by minimally trained personnel [4-9].

Whenever there is an increase in the blood urea, there will be a concomitant increase in the salivary urea. Increase in blood urea concentration could lead to diffusion of nitrogenous waste products into other body fluids like gastric secretions, saliva, and sweat. This finding was similar to the study conducted by Dhal berg [10] in parotid saliva. Increased salivary urea levels may indicate the need for treatment.

A comparative study was done in blood and saliva in pre and post dialysis state, so that when there is a decline in the blood parameters from the pre dialysis state to the post dialysis state, a simultaneous decline in the salivary parameters from the pre dialysis to post dialysis state was expected. The parameters which are considered in our study are urea, creatinine, sodium, potassium and phosphate.

Our data showed a significant correlation using paired T-test analysis between simultaneously drawn serum and salivary samples analysed for urea, cretinine, potassium and phosphate. But generally the significance in electrolytes is little less compared to that of urea and creatinine, particularly there is lack of significance in the sodium in both pre and post comparison in both serum and saliva. The lack of significant correlation with electrolytes, particularly sodium as in our study is understandable since it is known that salivary electrolytes are influenced by serum aldesterone levels and depletion of effective extracellular fluid volume is extremely common as a result of ultrafilteration of plasma during hemodialysis. This was similar to the study conducted by Dahl Berg et al., [10] and Robert D Goll [4].

It will therefore be possible to substitute unstimulated whole saliva samples in place of serum samples for these parameters whenever the clinical situation demands this, e.g. in situations where due to anaemia, small blood volume, difficulties in access for sampling, preservation of major veins for future arteriovenous shunts or for whatever other reasons, it may be deemed desirable to reduce the frequency of venipuncture and/ or blood samplings, which was also stated in a study conducted by Estela ML Cardoso et al., [11]. We believe that this may particularly be of value in some pediatric patients on chronic hemodialysis. The limitations of this study could be that the study has to be further expanded so, that the values can be standardized to utilize saliva as a diagnostic indicator for diagnosing renal disease but as of now it can be very well utilized as a prognostic indicator of the disease, thereby reducing the frequent blood test during the treatment of the renal disease.

CONCLUSION

It is thus possible that routine biochemical work using blood in chronic dialysis patients may be done at less frequent intervals by more frequent monitoring of salivary parameters. Salivary parameters in pre and post dialysis may also prove useful in occasional spot checks on efficiency of a given dialysis treatment in situations such as technical difficulties, poor blood flow due to access problems, etc. Spot checks on salivary samples also have potential usefulness in assessing the degree of azotemia in determining the need for dialysis treatment on a given day in several situations, e.g. increased dialysis need due to high catabolic state (sepsis supervening), intercurrent illness or other reasons developing unexpectedly.

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FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Jun 22, 2014**
Date of Peer Review: **Sep 15, 2014**
Date of Acceptance: **Sep 17, 2014**
Date of Publishing: **Dec 05, 2014**