Analysis of Blood and Salivary Urea Levels in Patients Undergoing Haemodialysis and Kidney Transplant

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ABSTRACT

Aims and Objectives: To determine correlation between the Salivary Urea (SaU) levels with that of Blood Urea (BU) levels.

Materials and Methods: Subjects were selected from patients undergoing haemodialysis HD and patients who had underwent kidney transplantation at Ashwini Hospitals Guntur. The study comprised of 45 patients, of which HD group with 20 patients, Transplant (T) group with 15 patients and 10 patients in control group. Samples of blood and saliva were taken from all the patients to assess the Blood Urea Nitrogen (BUN) and SaU levels respectively under strict aseptic precautions. Blood was collected just prior to the dialysis in HD group and in renal transplant (T)

patients during their review visit. Informed consent was taken from patients and ethical committee approval taken.

Results: There was a statistically significant difference between BU and SaU levels in the HD and T group (p<0.05). There was a statistically significant difference between T and Control group with respect to BU and SaU levels. The salivary urea levels are slightly higher than blood urea levels in all the study groups.

Conclusion: The SaU tests can be used in place of blood tests as a non invasive diagnostic tool. Thus, preventing the unnecessary and periodic withdraw of blood which is not only cumbersome but also leads to recurrent infections.

INTRODUCTION

Kidneys are vital organs for maintaining homeostasis and are the main excretory organs of the body. The structural and functional unit of kidney is called as nephron. Chronic Renal Failure is the disorder characterized by progressive and chronic deterioration of nephrons, leading to impaired functioning of kidneys. End Stage Renal Failure is a chronic condition, involving an irreversible loss of renal function. This results in retention of nitrogenous substances with elevation of Blood Urea Nitrogen (BUN) and non-protein nitrogen [1].

Most common laboratory investigation used to diagnose the renal disease is a hematological estimation of BUN or serum creatinine [2]. Elevation of BUN in renal diseases may results in high concentration of urea in saliva due to diffusion of nitrogenous waste into the saliva [3]. It is also possible that saliva may be an attempted alternative route of excretion by the body in compromised renal function state [4]. Wide ranges of systemic diseases are known to affect the salivary gland secretion and its composition [5]. Saliva is gaining wide momentum in recent years as a diagnostic tool due to its easy availability, non invasive method of collection [6,7].

The present study was conducted to assess the correlation between the SaU levels with that of BU levels in patients undergoing Haemodialysis HD and kidney transplant.

MATERIALS AND METHODS

The study design was simple randomized sampling type. The study was done for the period of six months. The purpose of undertaking this study was explained along with informed consent taken from all the subjects and ethical committee approval taken for this study. Subjects were selected from patients undergoing HD and patients who had underwent kidney transplantation at Ashwini Hospitals, Guntur, India. The study comprised of 45 patients of which, study group consist of 35 patients and control group of 10 patients. The

study group is subdivided into HD group with 20 patients and Transplant (T) group with 15 patients. Control group (C) comprised 10 healthy individuals selected from Dental OPD.

Selection of patients

An age group of 25 to 65 years matched for age and gender were selected for both groups. Patients with history of certain nephrotoxic drug intake and other systemic conditions were excluded. All the patients in the study groups were diagnosed with renal diseases like acute renal failure, chronic renal failure, acute nephrotic syndrome, glomerulonephritis etc. HD group consists of 20 patients (16 males and 4 females) bearing the disease for the past 1-5 years and undergoing HD once in a week for the period of 2 to 4 hours. T group consists of 15 patients (11 males and 4 females) who had undergone renal transplantation in the precedent one year.

C group comprised of 10 patients (6 males and 4 females) who were free from systemic disease and they were not under any medication for any of the systemic medical condition. An age group of 20 to 65 years matched for age and sexes were selected for all the groups.

Collection of Blood and Saliva

Renal patient's blood samples were collected during their review visit, under strict aseptic precautions. Un-stimulated whole saliva was collected between 9 to 11 am from all the three groups. The saliva was collected using spitting method in disposable, sterile, plastic containers (Nalgene Sterile Sample Bottles) with measurement markings. The collected samples were submitted for analysis of urea and nitrogen by an Automated Bio analyser.

RESULTS

In HD group, the Mean Blood Urea level was 71.75 (SD = ±23.15) and Mean SaU level was 97.15 (SD = ±34.12) respectively. Linear regression analysis showed statistically significant relation between

Variable	C-Group	Haemodialysis group (A)	Transplant group (B)	p-value
	Mean SD	Mean SD	Mean SD	
Age	25.2±3.82	48.0±12.61	41.2±12.64	<0.0001
Blood Urea	30.1±7.03	71.75±23.15	56.8±12.08	<0.0001
Salivary Urea	34.2±7.0	97.15±34.12	71.53±23.83	<0.0001
BUN	14.25±2.93	32.73±9.80	26.91±13.47	<0.001
SUN	14.60+5.49	46.33±15.43	33.18±10.54	<0.004

[Table/Fig-1]: Statistical comparison of mean values between different study groups

Group	Constant (a)	Regression Co-efficient (b)	p-Value	Regression Equation (y = a+bx)
Control (C)	31.58	-0.04	0.90	Blood urea = 31.58 – (0.04 X salivary urea)
Haemodialysis group (A)	34.06	+0.38	0.021	Blood urea = 34.06 + (0.38 X salivary urea)
Transplant group (B)	29.99	+0.37	0.0010	Blood urea = 29.99 + (0.37 X salivary urea)

[Table/Fig-2]: Linear regression analysis of blood urea and salivary urea levels in different study groups

BU and SaU in the HD group ($p<0.05$). In Transplant group (T), the Mean BU level was 56.8 (SD = ±12.08) and Mean SaU level was 71.53 (SD = ±23.83) respectively. Linear regression analysis showed statistically significant correlation between BU and SaU in the Transplant group ($p<0.05$). In control group (C), the Mean BU level was 30.1 (SD = ±7.03) and Mean SaU level was 34.2 (SD = ±7.0) respectively. According to Linear regression analysis there was no statistically significant relationship between BU and SaU in the control group ($p>0.05$) [Table/Fig-1].

Linear regression analysis showed a significant relationship between blood urea and salivary urea levels in HD group and in T group. Linear equation obtained in HD group was BU = 34.06 + (0.38 X SaU) and in T group, BU = 29.99 + (0.37 X SaU). These equations can be used for prediction purpose [Table/Fig-2].

DISCUSSSION

Diagnosis of renal diseases is usually done by serum and urine analysis, ultrasonography and pyelography. Serum chemistry includes BUN, Glucose; Creatine etc. are useful to evaluate the degree of renal impairment and disease progression. Urine examination in renal patients includes detection of protien (protenuria) and blood (hematuria). The oral cavity may show a variety of changes, as the body progress through an azotemic to uremic state. Dentist can help in early diagnosis of renal diseases by identifying the oral manifestations. Analysis of increased salivary urea levels in renal dialysis patients is a promising non invasive diagnostic tool. In a clinical study by Dhal berg et al., on parotid saliva of patients undergoing HD concluded that there exists a correlation between salivary and blood urea levels [8].

Normal blood urea concentration is 30-40 mg/dl where as the normal urea of saliva is 12-70 mg/dl [3] .In our study, mean salivary urea concentration in control group was 34.2±7.01 mg/dl whereas in HD group it was 97.15±34.12mg/dl. This study revealed that there exist a linear correlation between blood urea and salivary urea concentration in patients undergoing haemodialysis and kidney transplant. These finding were in accordance to the study conducted by Dhal berg et al., in parotid saliva [8]. Whenever there is an increase in the blood urea, there will be a concomitant increase in the salivary urea also. This is because the kidneys are unable to excrete urea in renal failure and hence its concentration in blood increases. The increased concentration in saliva may be because of increased serum urea which creates an increased concentration gradient which in turn increases the diffusion of urea from serum to saliva in HD patients [9].

Similar results were obtained in a study conducted by Hajer I A et al., salivary variables (calcium, phosphorous, urea and creatinine) were significantly related to serum variables for the HD patients and there was no correlation between salivary calcium and urea with serum calcium and urea for the control group [10]. Thus, not only the levels of urea but levels of other components are also affected in renal failure patients, due to reduced glomerular filtration rate secondary to altered function of nephrons. It is also possible that saliva may be an attempted alternative route of excretion by the body in a compromised renal function state.

In contrast to our results, a study done by Syed P A et al., to assess BU and SaU levels in End Stage Renal Failure patients, in HD group, the Mean BU level was 103.57 (SD = ± 35.42) and Mean SaU level was 107.52 (SD = ± 35.73) respectively. There was no statistically significant difference between BU and SaU in the HD group. Whereas in Control group it was 29.00 (SD = ± 4.55) and there was a statistically significant difference between HD group and Control group with respect to SaU levels [2].

In the present study there was no statistically significant correlation between SaU and BU in control group. In HD group, five of the patients showed blood urea levels higher than that of SaU; this could be due to the fact that patients selected randomly were undergoing dialysis.Their values would have differed, as they would have undergone dialysis a day before the test was carried out or it could be a physiological variation in those values. In T group two patients gave contrary results, this could be due to the fact that all these patients are undergoing medication after transplant and their salivary level is well within the normal range.

CONCLUSION

Our study concluded that SaU tests can replace conventional blood investigations, as a non invasive diagnostic tool thus preventing the unnecessary and periodic with drawls of blood which are not only cumbersome but also comes with an added risk of infection. Accordingly, monitoring of urea nitrogen concentrations should certainly be considered as a part of routine sialometric assessment in renal transplant and dialysis patients. We recommend the future studies in much larger cohorts of transplant and dialysis patients to evaluate the efficacy and feasibility of salivary analysis.

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