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Research Article

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Study of Pancreatic Enzymes in Chronic Kidney Disease Patients

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ABSTRACT

Background – Elevation in serum levels of amylase and lipase in the absence of pancreatitis, in CKD patients.
Aim – Evaluation of pancreatic enzymes level in CKD patients.
Materials and methods – 135 patients were included and they were classified in stage I - V of CKD according to KDIGO(Kidney Disease Improving Global Outcome) guidelines and their serum amylase and lipase levels were evaluated.
Results – We included 135 patients, in the age group of 30-60 yrs. Among 135 patients, 110 patients were divided in stages from I to V of CKD (Chronic Kidney Disease) as per KDIGO (Kidney Disease Improving Global Outcome), and 25 patients were divided in Pre HD and Post HD group. The serum amylase and lipase were significantly higher in CKD patients as the stage progresses form I to V (p= 0.000). In Pre HD and Post HD group of patients mean value of serum amylase and serum lipase were significantly higher in Post HD group in comparison to Pre HD (p=0.000)
Conclusion – Our study done among 135 patients indicate that there was certain amount of retention of pancreatic enzyme in CKD patients due to decreased excretion by kidneys. And patients on HD had elevated level of these enzymes in Post HD state which was probably due to increase in lipoprotein lipase from endothelial cells of capillaries and we were measuring Total lipase in serum. Secondly due to hemoconcentration which occurs during HD by removal of fluid from body. Hence levels of total amylase and lipase increases in serum after hemodialysis.

Key Words: *Amylase, Lipase, Pre Hemodialysis , Post Hemodialysis , End Stage Renal Disease , Kidney Disease Improving Global Outcome*

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INTRODUCTION

Kidneys are intra abdominal organs with functional unit being nephrons which consists of Bowmans capsule with glomerular tuft of capillaries, Proximal convulated tubule, loop of henle, distal convulated tubule and collecting ducts. The ultra filteration rate or glomerular filteration rate (GFR)is defined as the amount of plasma being filtered by glomeruli per minute. Renal failure is a condition when the function of the kidneys are compromised and they are not able to filter the waste products adequately. Two main forms are Acute Kidney Injury which is often a reversible condition and Chronic Kidney Disease is often non reversible condition.

CKD as per KDIGO is Kidney damage lasting ≥ 3 months , characterized by structural or functional abnormality of kidney , with or without reduced GFR , which can result in drop of GFR. It is estimated by calculating (CrCl) creatinine clearance using Cockroft and Gault Equation-

$$CrCl = \frac{(140\text{-Age}) \times \text{Lean Body Weight}}{\text{Serum Creatinine} \times 72} \quad \text{X } 0.85 \text{ if female}$$

Elevated levels of serum amylase and serum lipase is frequently seen in patients with CKD on HD irrespective of pancreatitis. However rise in the concentration of serum amylase and serum lipase are indicators of acute pancreatitis but these enzymes are raised in other non pancreatic conditions also. Decrease in the renal function or renal insufficiency is one of the common cause for such non specific elevation[1]. Further it is known that 24 % of the circulating amylase is excreted in urine[2]. The lipase is filtered by glomeruli and it is almost completely reabsorbed and metabolised by renal tubules[3]. Therefore the increase in the concentration of serum amylase and serum lipase reflects a reduction of glomerular filteration and is not generally due to pancreatic damage[4] .

Laboratory confirmation in the diagnosis of pancreatitis is difficult in patients with ESRD and cannot be supported only by serum amylase and serum lipase measurements.

Materials and Methods

Study Design-

We performed a observational cross sectional study in Clinical Biochemistry lab in collaboration with Nephrology Department of Maharana Bhupal Govt. Hospitals attached to RNT Medical College Udaipur (Raj.) from November 2021 to November 2022 after Ethical Clearance from Institutional Ethical Committee in which 135 patients were included of CKD irrespective of treatment and stage of kidney failure.

Patients Distribution – In the present study 135 patients were divided into various stages of CKD (stage I-V). Out of these 135 patients, 110 were distributed in stage I-V and 25 patients were grouped in PRE HD and POST HD.
Out of 110 patients stage I had comprised 20 patients, stage II had 20 patients, stage III had 21 patients, stage IV had 16 patients, stage V had 33 patients.

None of the patients presented with clinical signs and symptoms of acute and chronic pancreatitis. Exclusion was based on establishing two of the following three criterias-

- Typical abdominal pain radiating to back .
- Three fold or greater elevation in serum amylase and lipase.
- Confirmatory findings of pancreatitis on sonography[5].

Evaluation Methods

Serum amylase and serum lipase activities were measured using colorimetric assay on Siemens Dimensions RxL Max auto analyzer.

Statistical analysis

Continuous variables were presented as mean values and standard deviation. For categorical variables percentage are given. Variables were compared using Chi Square test. All analysis was performed with the SPSS software (version 21.0) and p value <0.05 was considered statistically significant.

Results

In our present study it was observed that preponderance of female sex was more as compared to male in Chronic Kidney Disease patients. In stage I, there were 20 patients, mean value of serum amylase was 71.10±35.33 and lipase was 97.35 ± 93.23. In stage II, there were 20 patients, mean value of amylase was 76±25.12 and lipase was 181.44 ±69.97. In stage III there were 21 patients, mean value of amylase was 86.52 ±31.64 and lipase was 232.55±117.13. In stage IV, there were 16 patients, mean value of amylase was 109.19±55.96 and lipase was 428.40±358.56. In stage V, there were 33 patients, mean value of amylase was 133.27 ±70.77 and lipase was 524.88±508.85. The mean values of amylase and lipase level increases as the stage of CKD progresses with a significant difference and it was independent of pancreatitis. But markedly increased levels were observed in stage IV and V.

Table 1- Patients distribution in various stages of CKD

Gender	**Stage**				
	I (n=20)	**II (n=20)**	**III (n=21)**	**IV (n=16)**	**V (n=33)**
Male	8 (40.0%)	8 (40.0%)	10 (47.6%)	6 (37.5%)	19 (57.6%)
Female	12 (60.0%)	12 (60.0%)	11 (52.4%)	10 (62.5%)	14 (42.4%)

Table 2 – Distribution of patients in Pre HD and Post HD group

	Pre HD n=25	**Post HD n=25**
Males	**17 (68%)**	**17 (68%)**
Females	**8 (32%)**	**8(32%)**

(Note- Patients included in Pre HD group and Post HD group are same)

Table 2 – Comparison of serum amylase in different stages of CKD

	Stage				
	I (n=20)	**II (n=20)**	**III (n=21)**	**IV (n=16)**	**V(n=33)**
Amyalse(U/L)	71.10±35.33	76.00±25.12	86.52±31.64	109.19±55.96	133.27±70.77

Table 3 -Comparison of serum Lipase in different stages of CKD

	Stage				
	I (n=20)	**II n=20)**	**III (n=21)**	**IV (n=16)**	**V (n=33)**
Lipase(U/L)	97.35±93.23	181.44±69.97	232.55±117.13	428.40±358.56	524.88±508.85

In Pre HD and Post HD group there were 25 patients and mean serum amylase level in Pre HD group was 152.44±92.59 and in Post HD group was 191.64 ±106.00. The mean serum lipase level in Pre HD group was 539.99±260.92 and Post HD group was 691.67±338.30. The mean value of serum amylase and lipase level increases in comparison with Pre HD and Post HD group of CKD patients with a significant difference (P-0.000).

Table 4 - Comparison of serum amylase in Pre HD and Post HD group of patients

	Pre HD	**Post HD**
Amyalse(U/L)	152.44±92.59	191.64±106.00

Table 5 - Comparison of serum lipase in Pre HD and Post HD group of patients

	Pre HD	**Post HD**
Lipase(U/L)	539.99±260.92	691.67±338.30

DISCUSSION

Our study demonstrated that mean serum amylase and serum lipase increases in various groups of CKD patients as the stage of CKD progresses form stage I to stage V independent of pancreatitis. Elevated serum levels of pancreatic enzymes has been reported in patients with renal dysfunction [1,6,7].

Elevation of serum pancreatic enzymes in CKD patients could be explained by probable rationale that almost 25 % of circulating amylase is excreted in urine. Lipase is filtered by glomerulus and almost completely reabsorbed and metabolised by renal tubules. Therefore the increase in renal amylase and lipase reflects a decreased renal clearance and is not due to pancreatic disorder.

In our study hyperamylasemia in Post HD group of patients was nearly two times of upper limit of normal and hyperlipasemia in Post HD group of patients was nearly three times of upper limit of normal.

Similar to our findings Masoero G et al [6] , Jiang et al [8], Lin XY et al[1], Vaziri ND et al [7]found that levels of serum pancreatic enzymes elevated upto three times upper limit of normal in 60 – 80 % of patients under HD who did not had evidence of acute pancreatitis.

The probable rationale for the increase in the serum levels of amylase and lipase in post HD group of patients is independent of pancreatitis and is due to the lipoprotein lipase which is anchored to heparan sulphate in the endothelial cells of capillaries and on systemic administration of heparin the binding of lipoprotein lipase with heparan sulphate is disrupted which increases lipoprotein lipase and we are measuring Total lipase in serum. Hence levels of total lipase increases in serum after HD and secondly hemoconcentration also occurs which is due to the fluid removal during dialysis which also contributes to the increase of amylase and lipase in serum.

CONCLUSION

Our study done among 135 patients indicate that there was certain amount of retention of pancreatic enzyme in CKD patients due to decreased excretion by kidneys. These pancreatic enzymes acts as a diagnostic tool in diagnosing acute pancreatitis which leads to false positive results in CKD patients. And patients on HD had elevated levels of these enzymes which was probably due to systemic administration of heparin binding of lipoprotein lipase with heparan sulphate is disrupted which increases lipoprotein lipase and we are measuring Total lipase in serum. Secondly due to hemoconcentration which occurs during HD by removal of fluid from the body.

Limitation

The major limitation of this study include short sample size , estimation of total amylase and lipase and absence of the imaging studies of pancreas.

List of abbreviations

CKD – Chronic Kidney Disease
ESRD- End Stage Renal Disease
KDIGO- Kidney Disease Improving Global Outcome
GFR- Glomerular Filteration Rate.
HD- Hemodialysis

Conflicts of interest- There is no conflict of interest regarding the publication of this paper.

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