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STUDY OF DERANGEMENT OF RENAL PARAMETERS IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT

Background: Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory condition with systemic manifestations and comorbidities that significantly impact morbidity and mortality. Among these, renal dysfunction is increasingly recognized as an important yet underexplored complication.
Objective: To evaluate the prevalence and pattern of renal parameter derangement in patients with COPD and to assess the correlation between the severity of pulmonary impairment and renal function.
Methods: This observational cross-sectional study included clinically diagnosed COPD patients who were evaluated for renal function through serum creatinine, estimated glomerular filtration rate (eGFR), and blood urea nitrogen (BUN). Pulmonary function was assessed based on the GOLD (Global Initiative for Chronic Obstructive Lung Disease) criteria. Statistical analysis was performed to identify correlations between renal parameters and COPD severity
Results: The mean serum creatinine levels were significantly higher in the COPD group (1.39 mg/dL) compared to the control group (0.91 mg/dL).The mean eGFR was significantly lower in the COPD group (62.3 mL/min/1.73 m^2) compared to controls (93.1 mL/min/1.73 m^2),. BUN levels were also significantly higher in COPD patients (24.3 mg/dL) compared to controls (12.3 mg/dL). A significant correlation was found between reduced eGFR and COPD severity, with higher stages showing greater reductions in eGFR.
Conclusion: This study demonstrates a significant correlation between COPD severity and renal dysfunction, with reduced eGFR being more prevalent in advanced stages of COPD. Abnormal serum creatinine and BUN levels were also observed in COPD patients compared to healthy controls. These findings emphasize the need for regular renal monitoring in COPD patients, especially those with advanced disease.

Keywords: Chronic Obstructive Pulmonary Disease (COPD), Renal Function Electrolyte Imbalance

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a leading cause of morbidity and mortality worldwide, characterized by persistent respiratory symptoms and airflow limitation due to airway and/or alveolar abnormalities. Traditionally viewed as a localized pulmonary condition, COPD is now increasingly recognized as a systemic illness with wide-ranging effects beyond the lungs. Among the various extrapulmonary complications, renal dysfunction is gaining attention due to its potential impact on the clinical course and prognosis of COPD patients.
The kidneys play a crucial role in maintaining homeostasis, and their function can be compromised by several mechanisms active in COPD, including chronic hypoxemia, systemic inflammation, and oxidative stress. These factors can collectively lead to subtle or overt alterations in renal function, which may go unnoticed until they contribute to significant clinical deterioration. Despite the growing awareness of the cardiopulmonary-renal axis, the specific derangements in renal parameters among COPD patients remain insufficiently explored in many clinical settings.
This study aims to evaluate renal function abnormalities in COPD patients by assessing relevant biochemical parameters and correlating them with the severity of pulmonary dysfunction. A deeper understanding of these associations may facilitate early intervention strategies, reduce complications, and improve overall patient outcomes.

Renal Parameters in COPD Patients

Renal dysfunction can manifest in several forms, from acute kidney injury (AKI) to chronic kidney disease (CKD), and can significantly affect the prognosis of COPD patients. The primary renal parameters that are monitored in clinical settings include:

2.1 Glomerular Filtration Rate (GFR)

GFR is a key indicator of kidney function, reflecting the rate at which blood is filtered by the glomeruli. In COPD patients, a reduced GFR can indicate chronic kidney disease. Studies have shown that GFR is often lower in COPD patients compared to healthy individuals, suggesting a higher prevalence of renal impairment in COPD.

2.2 Serum Creatinine and Blood Urea Nitrogen (BUN)

Serum creatinine levels are commonly used to assess kidney function, as it is a waste product filtered by the kidneys. Elevated creatinine levels are often a marker of reduced kidney function. BUN levels, while less specific than creatinine, can provide additional insight into renal function and fluid balance. In COPD patients, both serum creatinine and BUN levels are frequently found to be elevated, which may indicate renal insufficiency or impairment.

Pathophysiology of Renal Dysfunction in COPD

The pathophysiological mechanisms behind renal dysfunction in COPD are complex and multifactorial. Several key processes are involved:

3.1 Systemic Inflammation

Pro-inflammatory cytokines such as interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), and C-reactive protein (CRP) have been shown to contribute to both lung and kidney damage. These inflammatory mediators can impair renal blood flow, cause glomerular injury, and increase the risk of proteinuria.

3.2 Hypoxia

Chronic hypoxia, a hallmark of advanced COPD, can contribute to renal dysfunction. Low oxygen levels lead to the activation of hypoxia-inducible factors (HIFs), which in turn can lead to vasoconstriction in the renal vasculature and a reduction in renal perfusion.

3.3 Renin-Angiotensin-Aldosterone System (RAAS) Activation

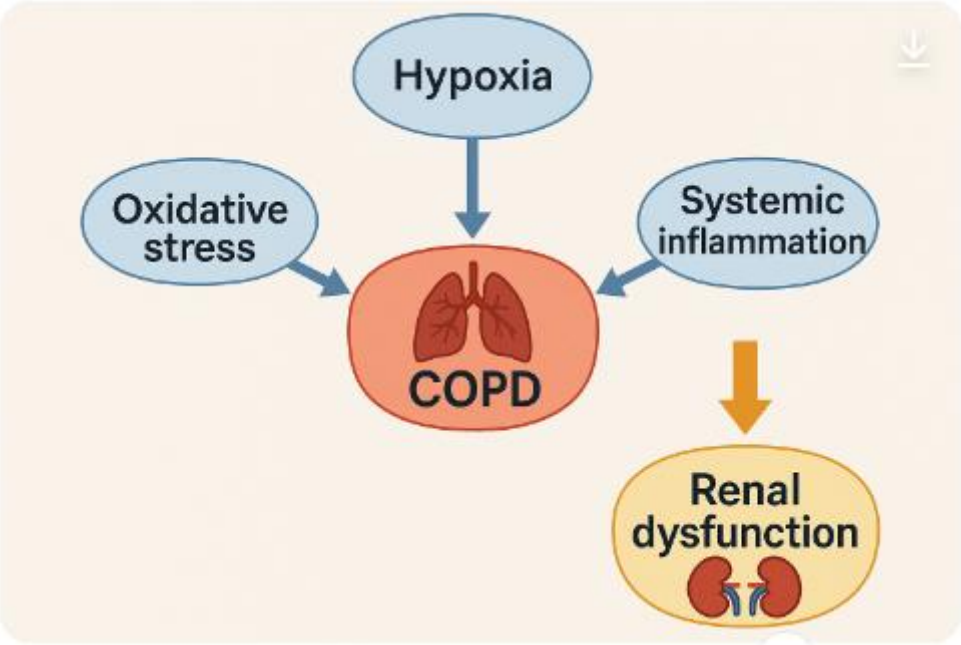
In COPD patients, the activation of the RAAS plays a critical role in both the pulmonary and renal systems. RAAS activation can lead to vasoconstriction, sodium retention, and hypertension, which in turn can exacerbate kidney damage.

3.4 Medications and Diuretics

Many COPD patients are prescribed medications that can influence renal function, including diuretics, beta-agonists, and corticosteroids. Diuretics, commonly used to manage fluid retention in COPD with cor pulmonale, can lead to dehydration and electrolyte disturbances, which further impair kidney function

3.5 Cardiorenal Syndrome

The interplay between the heart and kidneys is another crucial aspect of renal dysfunction in COPD patients. COPD can lead to right heart failure (cor pulmonale), which in turn can impair renal perfusion, leading to kidney injury..



MATERIAL AND METHODS

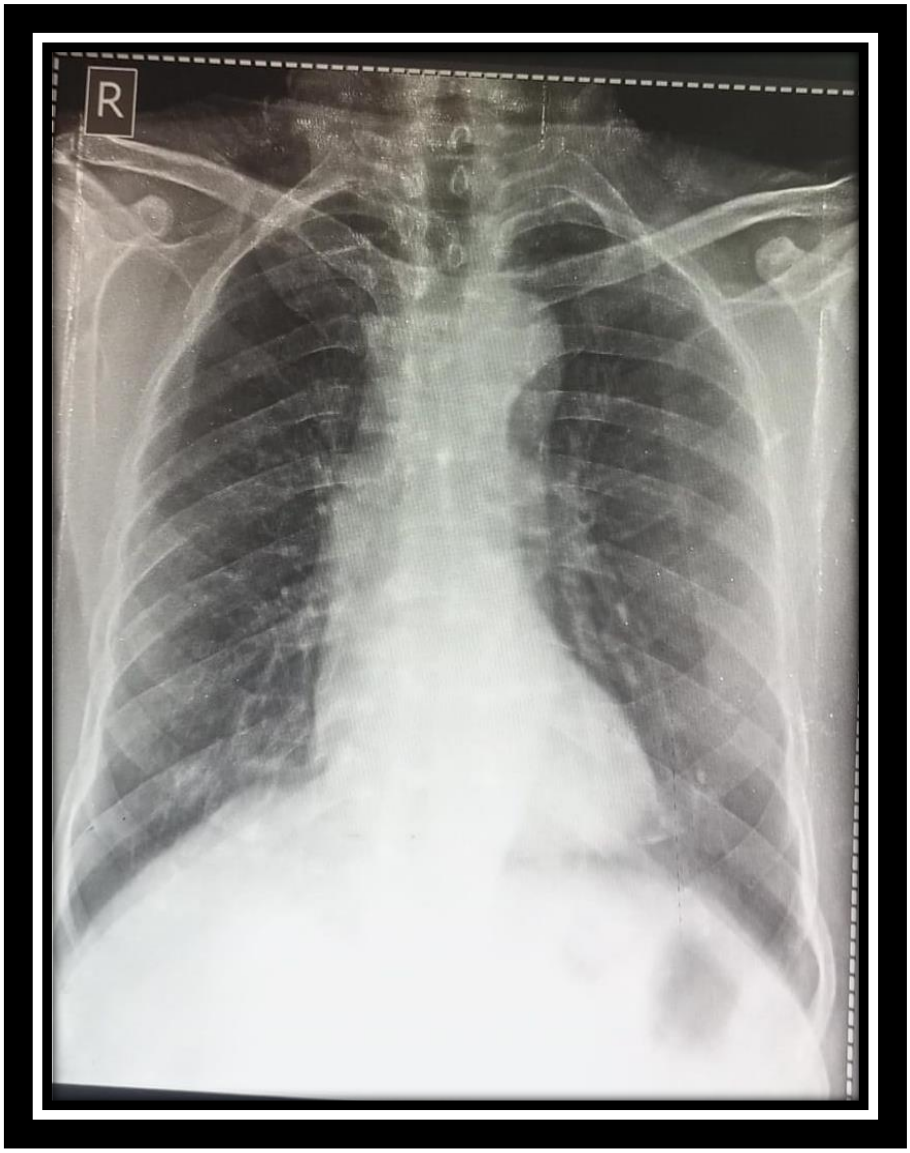
The study is being conducted at Krishna Mohan Medical College & Hospital in Mathura, U.P., and is designed as a cross-sectional study with a duration of 18 months and a sample size of 80 participants. The inclusion criteria consist of patients aged 40 to 70 years with a confirmed COPD diagnosis (GOLD stage II-IV), both male and female, with available data on urine biomarkers, urinary albumin, eGFR, and serum creatinine. Exclusion criteria include patients with an unconfirmed COPD diagnosis, those with other respiratory disorders like bronchiectasis or asthma that could affect renal parameters, individuals with advanced kidney disease or unrelated chronic kidney conditions, patients with incomplete renal data, and those with serious comorbidities that could confound the results. Data will be collected by reviewing the medical records of eligible patients, including information on age, gender, medical history, COPD severity (GOLD classification), smoking history, medication use, comorbidities such as hypertension and diabetes, and any prior renal function evaluations or relevant lab tests.

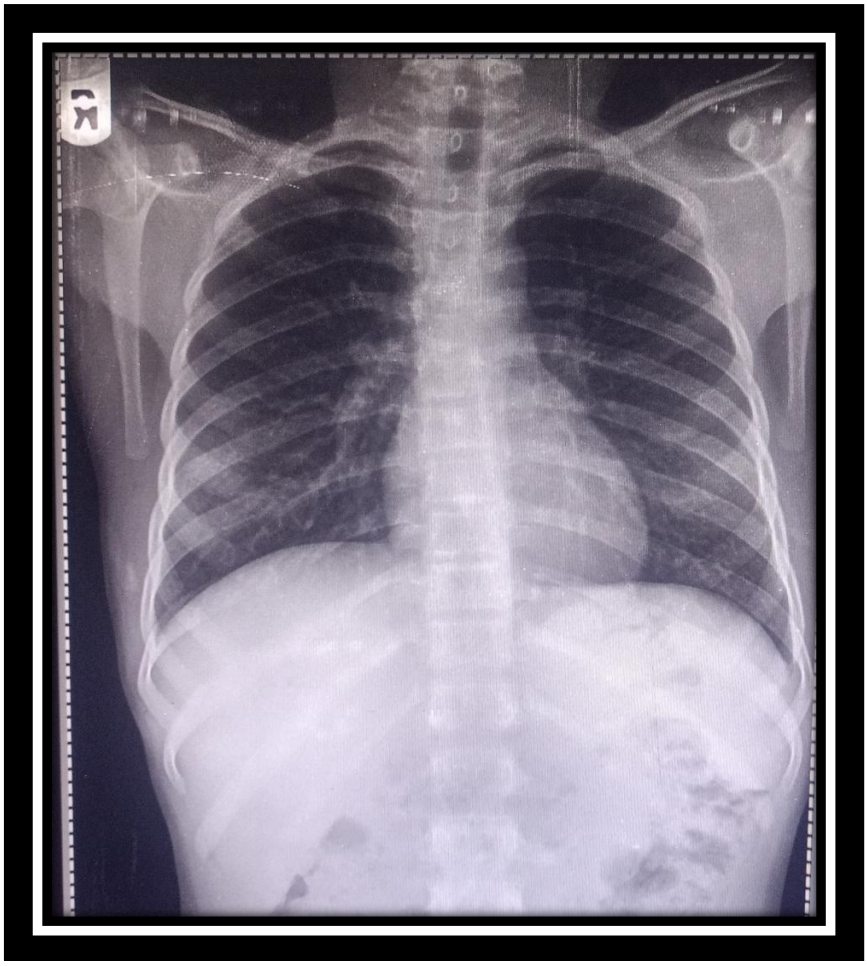
METHODOLOGY

This study is a cross-sectional observational study conducted over a period of 18 months at Krishna Mohan Medical College & Hospital, Mathura, Uttar Pradesh. The aim of the study is to assess the derangement of renal parameters in patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD).A total of 80 participants were enrolled in the study based on predefined inclusion and exclusion criteria.

Data was collected retrospectively by reviewing the medical records of eligible patients. The following parameters were extracted and recorded . Age and gender ,Smoking status, duration and severity of COPD (based on GOLD classification. Presence of hypertension, diabetes mellitus, and other relevant conditions. Use of bronchodilators, corticosteroids, nephrotoxic drugs, or any long-term medication.renal parameters including serum creatinine levels,estimated GFR (eGFR) calculated using CKD-EPI or MDRD equation ,urinary albumin levels and other relevant urinary biomarkers, if available Collected data will be entered into a Microsoft Excel spreadsheet and analyzed using SPSS version [insert version here] or a similar statistical software. Descriptive statistics (mean, standard deviation, frequencies, and percentages) will be used for demographic and clinical characteristics. Comparison of renal parameters across different GOLD stages of COPD will be conducted using appropriate statistical tests (e.g., ANOVA, chi-square test, or t-test depending on data distribution). A p-value of <0.05 will be considered statistically significant.

Ethical approval for the study was obtained from the Institutional Ethics Committee of Krishna Mohan Medical College & Hospital. Patient confidentiality was maintained by anonymizing the data, and no direct patient identifiers were used in the analysis.





SAMPLE TYPE : SERUM

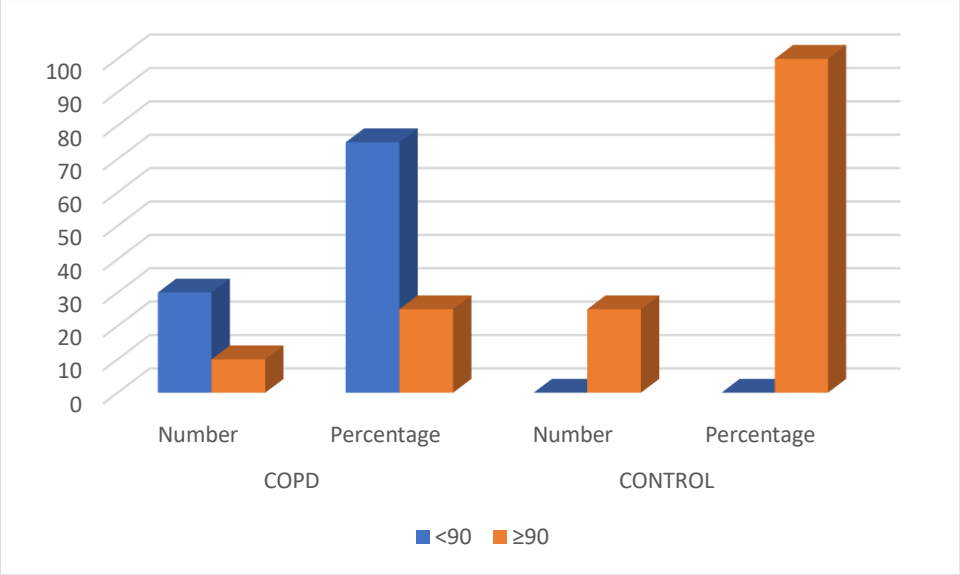
Investigations	Result	Unit	Biological Reference Interval
KIDNEY FUNCTION TEST (KFT)			
SERUM UREA	140.0	mg/dl	13-45
SERUM CREATININE	**1.96**	mg/dl	0.7-1.5
SODIUM (Na+)	140.8	mEq/l	135-145
POTASSIUM (K+)	4.14	mEq/L	3.5-5.5

RESULTS

Table 1: eGFR

eGFR	COPD		CONTROL	
	Number	Percentage	Number	Percentage
<90	30	75	0	0
≥90	10	25	40	100
Total	40	100	40	100
Mean	62.3		93.1	
SD	21.2		13.2	
p-value	0.0012 (Significant)			

Graph 1: eGFR

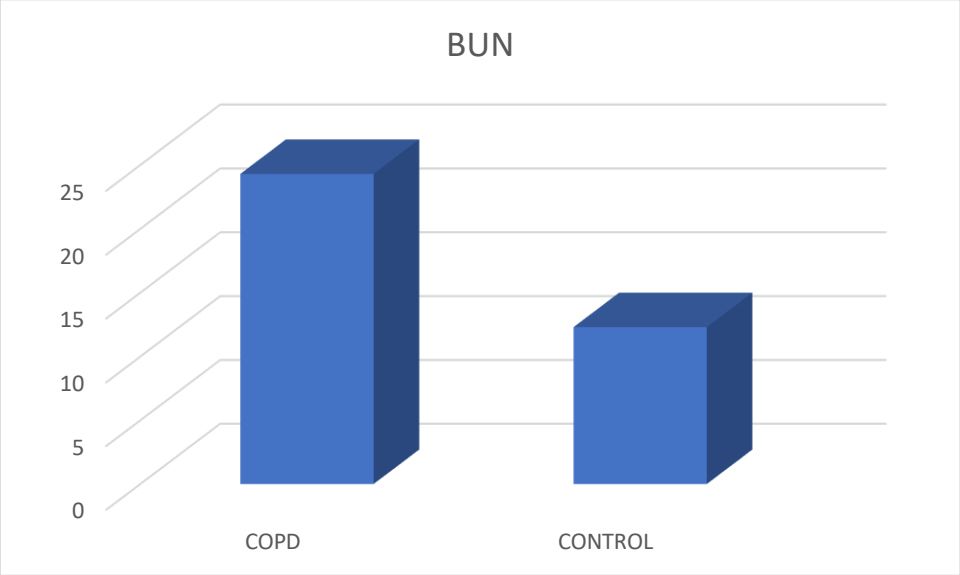


Mean serum eGFR levels among COPD group and control group was 62.3mL/min/1.73 m^2 and 93.1mL/min/1.73 m^2 respectively. eGFR levels among COPD group was significantly lower in comparison to eGFR levels of the control group. Abnormal eGFR levels were seen in 75 percent of the COPD patients

Table 2 :BUN levels (mg/dL)

BUN	COPD	CONTROL
Mean	24.3	12.3
SD	14.2	2.1
p-value	0.003 (Significant)	

Graph 2: BUN levels (mg/dL)



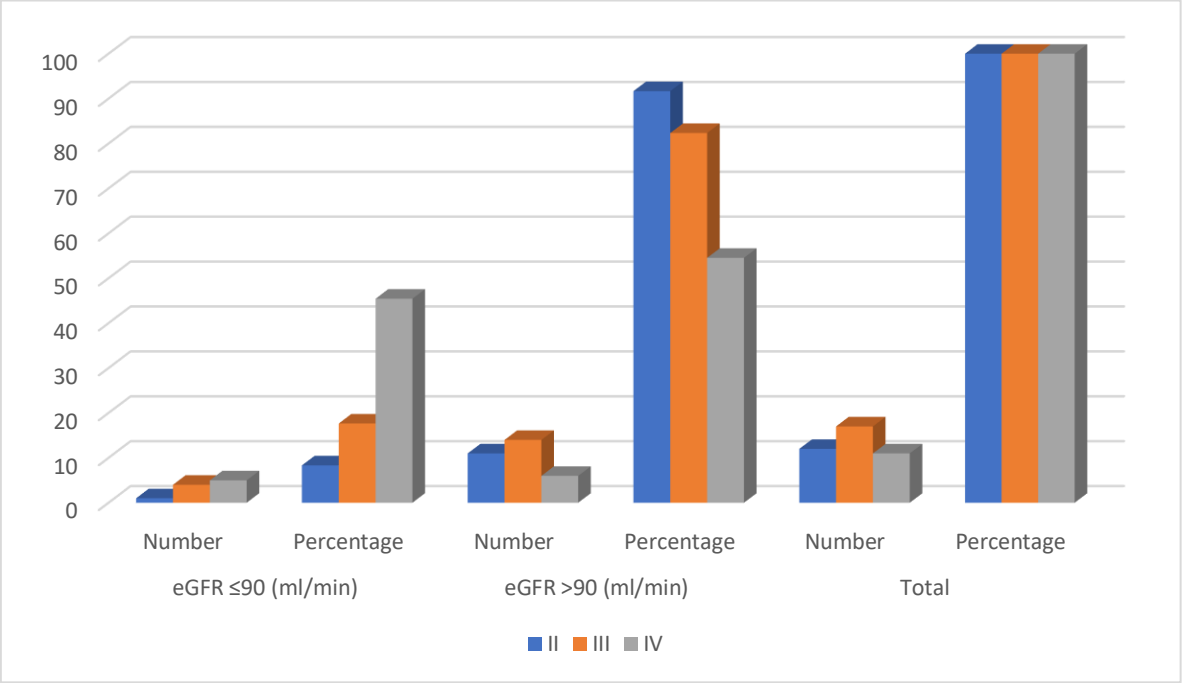
Mean BUN levels among COPD patients and healthy controls was 24.3 mg/dL and 12.3 mg/dL. While comparing the results, significant results were obtained.

Table 3: Correlation of severity staging of COPD with eGFR levels

Staging	eGFR ≤90		eGFR >90		Total	
	Number	Percentage	Number	Percentage	Number	Percentage

II	1	8.33	11	91.67	12	100
III	4	17.65	14	82.35	17	100
IV	5	45.45	6	54.55	11	100
Total	10	25	30	75	40	100
p-value	0.002 (Significant)					

Graph 3: Correlation of severity staging of COPD with eGFR levels

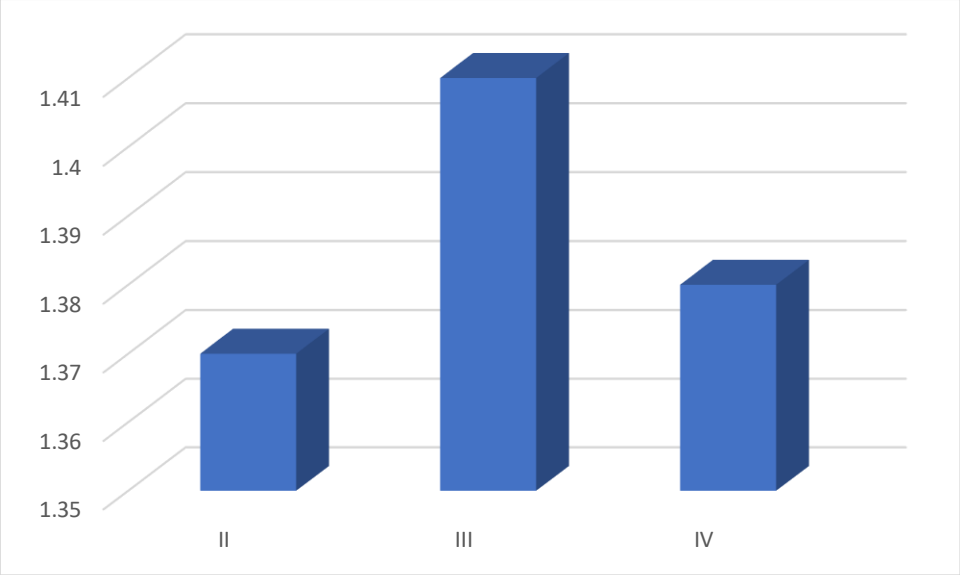


Among patients with stage III COPD, 17.65 percent of the patients had reduced eGFR. Among patients with stage IV COPD, 45.45 percent of the patients had reduced eGFR. Significant results were obtained while correlating eGFR with severity of COPD

Correlation of serum creatinine levels with COPD staging

Stage	Mean	SD	p-value
II	1.37	0.5	0.752
III	1.41	0.6	
IV	1.38	0.5	

Graph15: Correlation of serum creatinine levels with COPD staging



Mean serum creatinine levels among COPD group and control group was 1.39 mg/dL and 0.91 mg/dL respectively. Abnormal serum creatinine levels were seen in 35 percent of the patients of the COPD group

DISCUSSION

In the study of 80 patients ,40 COPD and 40 control,my study found that serum creatinine levels were significantly higher in the COPD group, 52% higher than the control group. The mean eGFR was significantly lower in the COPD group, 49% lower than the control group,. BUN levels were also significantly higher in COPD group than control(97% above baseline).

In a study of 300 COPD patients, Elmahallawy and Qora examined the prevalence of underdiagnosed CRF. In 54, 26, and 20% of the COPD patients, they discovered normal renal function, while in the control group, the corresponding numbers were 78, 10, and 12%. They came to the conclusion that estimated GFR was required for screening and that chronic renal failure (CRF) was a significant comorbidity.

The prevalence of renal function deficits among patients with COPD who are admitted to a hospital in south was investigated by Arulkumaran P. 5 (1), 295-299, Int J Acad Med Pharm 2023.

According to Saravanan M, 83% of people had renal dysfunction.renal failure (GFR <60 ml/min and S.creatinine>1.2 mg/dl) was present in 7% of them, while concealed renal failure (GFR <60 ml/min but S.creatinine<1.2 mg/dl) was present in 34.9% of them. According to Singh AK et al. (2010), almost 6% of people had CKD with an eGFR of less than 60. According to Singh NP et al. [11], the prevalence of renal failure (eGFR<60) was 4.2% in semi-urban areas and 6% in urban areas. According to a research by Tiwari et al. [12], 4% of people had it. Therefore, a comparison with comparable Indian research revealed that, in comparison to the general population, the prevalence of renal impairment was four times greater among people with COPD.According to Elmahallawy et al. [13], the prevalence of renal impairment has climbed to 46%. Twenty percent of patients had overt renal failure, and twenty-six percent had disguised renal failure. According to Lattanzio et al. [14], 43% of people have renal failure. Among them, 20.8% had concealed renal failure and 22.2% had overt renal failure. According to Yoshizawa et al. [15], renal failure occurred in 31% of the research participants

CONCLUSION

COPD is one of the most common diseases worldwide and commonly comorbid with other diseases and managing patients could be difficult. COPD patients have a higher risk of developing CKD than the general population. The disease association including COPD, hyperuricemia and kidney failure persists even after correction for the known risk factors involved in renal damage. Therefore, the evaluation of serum UA levels and treatment of hyperuricemia play crucial roles in the management of COPD patients

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