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EVALUATION OF CARDIOVASCULAR COMPLICATIONS IN PATIENTS WITH CHRONIC KIDNEY DISEASE

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Abstract:

Background: *Cardiovascular disease (CVD) is the main cause of death in the chronic kidney disease (CKD) patients, whether on dialysis or on moderate therapy. The functioning of the heart and the kidneys is tightly interlinked together. This results in the primary disorder of one of these organs causing the secondary dysfunction of another. A better understanding of cardiovascular risk factors, clinical findings and cardiac findings are main keys to develop strategies to reduce CV morbidity and mortality among CKD patients. This study discusses some aspects of CKD, CVDs, their pathophysiology and corelation of various biochemical parameters involved in both CKD and CVDs.*

Objective: *To evaluate the prevalence of different Cardiovascular complications occurring in Chronic Kidney Disease patients.*

Materials and Methods: *The study is a prospective observational study conducted in Chronic Kidney Disease patients having secondary cardiovascular complications. The enrolment was carried out between August 2021 and January 2022. Altogether 150 Indian patients diagnosed to have Chronic Kidney Disease were enrolled and are included in the study.*

Results: *The prevalence of heart failure (71.3%) was the highest, followed by CAD (65.3%) and ACS (48.7%). The prevalence of other CVDs such as, Valvular heart disease (n=68), Cardiomyopathy (n=65), TIA (n=42), CVA (n=30), Ventricular Arrhythmia (n=26), Atrial Fibrillation (n=24), PAD (n=14), Sudden Cardiac Arrest (n=8), were reported to be 45.3%, 43.3%, 28.0%, 20.0%, 17.3%, 16.0%, 9.3% and 5.3%, respectively. CRHD (n=6) was the least prevalent CVD (4.0%) among all the patients.*

Conclusion: *This study concludes that Chronic Kidney Disease is a significant risk factor for development of Cardiovascular Diseases. CV related co-morbidities in CKD have a significant role in development of CVDs in Chronic Kidney Disease patients. The incidence and prevalence of CVDs in Chronic Kidney Disease is high. The severity of Chronic Kidney Disease is associated with increased risk of cardiovascular death.*

Keywords: *Chronic Kidney Disease, Cardiovascular disease, Hypertension, Diabetes Mellitus, Dyslipidaemia, Cardiac Biomarkers, Heart failure, Cardio-renal syndrome, Angina, Cardiomyopathy, Arrhythmia, Atrial Fibrillation, Hypertension, End Stage Renal Disease, Haemodialysis, Serum Creatinine.*

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INTRODUCTION:

The functioning of the heart and the kidneys is tightly interlinked together. This results in the primary disorder of one of these organs causing the secondary dysfunction of another [1]. Chronic kidney disease (CKD) is a health issue affecting populations globally and causing adverse outcomes of kidney failure, cardiovascular diseases (CVD), and leading to premature deaths [2]. It is estimated that over 10% of the adult population in the developed countries have a certain degree of chronic kidney disease (CKD) [3]. The alarming factors for occurrence of cardiovascular diseases leading to morbidity and mortality remains elevated in every stage of chronic kidney disease (CKD) [4].

CHRONIC KIDNEY DISEASE (CKD):

The present global guidelines define Chronic Kidney Disease (CKD) as a condition with decreased kidney function shown by a GFR less than 60 mL/min per 1·73 m² or including markers of kidney deterioration, or both, of the shortest duration of at least 3 months, regardless of the underlying cause [5]. [Figure 1] elaborates different stages of CKD.

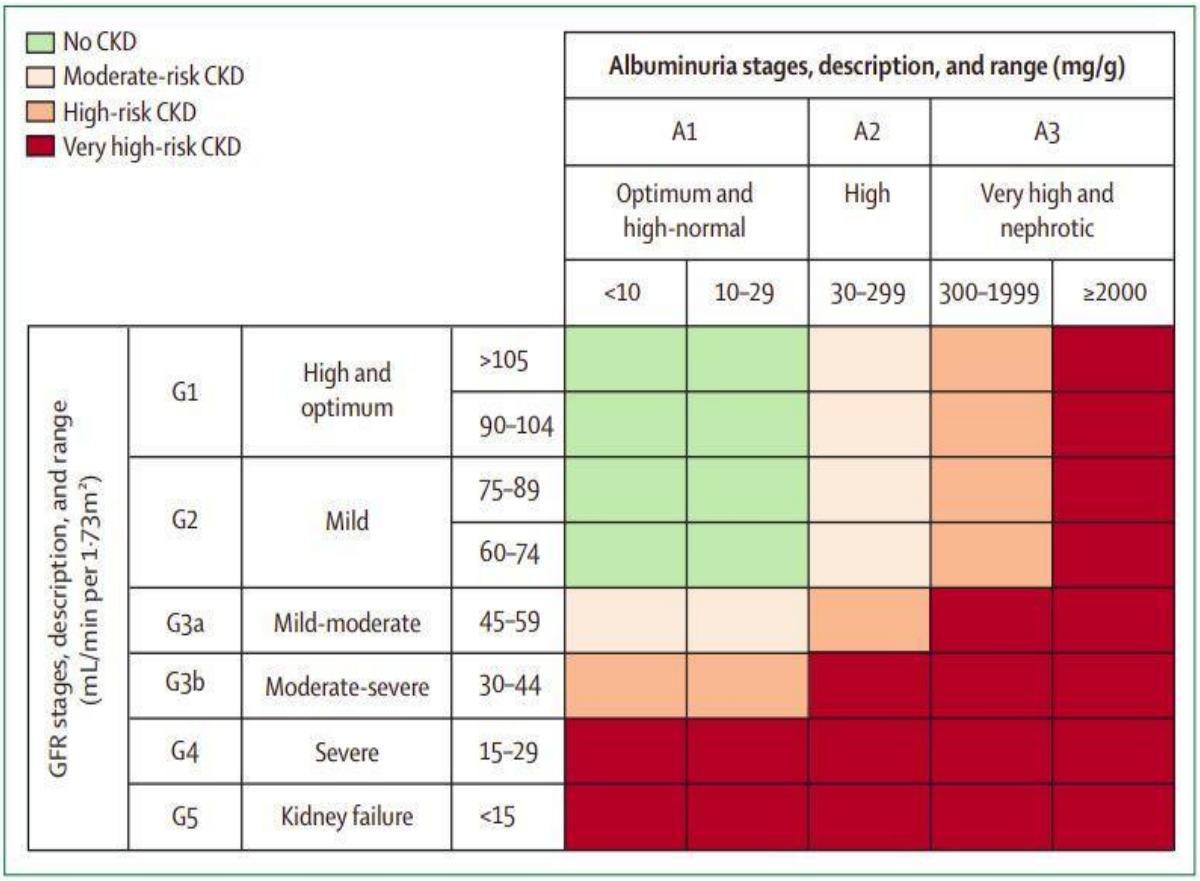

Figure 1. Stages of CKD [6]

CARDIOVASCULAR DIESEASE IN CHRONIC KIDNEY DISEASE:

Cardiovascular disease (CVD) is defined as the presence of IHD, HF, or LVH. Other Cardiovascular conditions that are more common in CKD patients include sudden cardiac arrest, atrial fibrillation, and cardiomyopathy [7]. CVDs represent the typical cause of death in CKD and ESRD patients [8]. Cardiovascular risk is notably found with stage III b-IV renal disease and in patients who experienced RRT [9].

The linkage between CKD and CVD is predictable for several causes:

- Risk factors for CVD are commonly occurring in CKD.
- CKD is associated with an increased prevalence of conventional CVD risk factors.
- Patients with CKD display a variety of unconventional CVD risk factors.
- CKD is an independent risk equivalent of CVD by itself.

- The presence of CVD predicts a faster decline in the functioning of the kidney [10].

PATHOGENESIS:

Myocardial and arterial remodelling constitute the main pathway in pathogenesis. Vascular pathology in CKD includes accelerated atherosclerosis, arteriosclerosis, vascular calcification, and endothelial dysfunction. CKD mimics an accelerated ageing of the cardiovascular system [11]. Vascular remodelling occurs in both arterial lumen and vessel wall components, leading to arteriosclerosis and atherosclerosis respectively. Intimal fibro-fatty plaque formation is the hallmark of atherosclerosis and is highly prevalent in CKD. The residual effects are isolated systolic HTN leading to LVH increased myocardial oxygen demand, and altered coronary perfusion and blood flow distribution leads to subendocardial ischemia, which is identified as an independent predictor of overall and cardiac mortality [10].

CRS Type-4:

The cardiorenal syndrome has five characteristic types of sub divisions according to the initial organ affected and the nature of the injury. The CRS worsens the CV complications in CKD leading to CV injury [12]. The complex and bi-directional pathophysiology corresponds between the heart and kidneys [13]. This syndrome includes a wide range of clinical effects acutely or chronically affecting both the organs. Plasma levels of specific biomarkers help in the reporting of adverse CV outcomes. Troponins, natriuretic peptides, C-reactive protein, serum amyloid A protein, haemoglobin, etc. are a few biomarkers that help with predicting cardiovascular risk in CKD patients. The observations provide a connection between chronic inflammation, subclinical infections, accelerated atherosclerosis, heart–kidney interactions, and negative cardiovascular and renal outcomes [14].

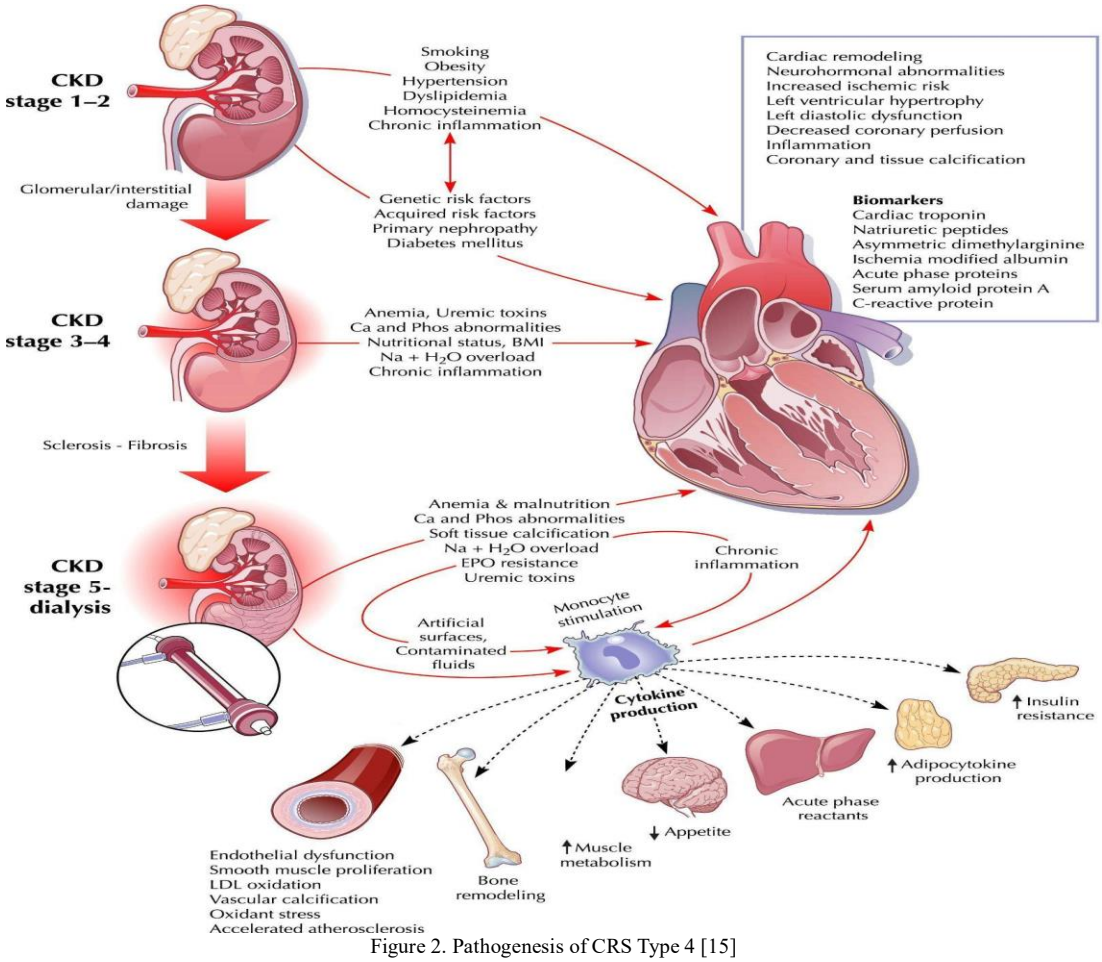

Figure 2. Pathogenesis of CRS Type 4 [15]

FRAMINGHAM RISK SCORE:
The disseminated multivariable statistical models developed and used by Framingham helped to estimate the risk of heart diseases. They measure the importance of risk factors on the development of heart diseases and estimate the risk over a predetermined period, for instance, in the next 10 years. A system of points is developed, which is used to make complex statistical models easy for practitioners, as it does not require a calculator or computer and simplifies the estimation of risk based on complex statistical models. Conventional Framingham risk factors include hypertension (HTN), smoking, dyslipidemia, and diabetes mellitus (DM). Additional factors included are obesity, left ventricular hypertrophy (LVH), family history of coronary artery disease (CAD) [16].

I. MATERIALS AND METHODS:

Study site: The study was conducted in the Department of Nephrology, Aster Prime Hospital, Hyderabad, Telangana, India.

Study duration: The study was conducted for a period of 6 months from August 2021 to January 2022.

Study design: The study is a prospective observational study.

Sample size: The sample size of the study population was calculated based on the overall prevalence of Chronic Kidney Disease in the Indian population. An estimate of that magnitude with 95% confidence limits required a sample size of 138. With around 10% allowance for any dropouts, the calculated sample was 150.

DATA COLLECTION:
Permission from hospital authorities was obtained to collect the data from participants after describing study objectives to participants and written consent was received from each patient. Clinical information and biological specimens for each patient were collected on admission. Their demographics (Age, gender), medical history (co-morbidities like Hypertension, Diabetes Mellitus, Dyslipidaemia and Cardiovascular Diseases) was documented. 2D ECHO, Chest X-Ray, Coronary Angiography and biochemical parameters and Cardiac biomarkers were measured in the hospital laboratory to avoid testing variations among laboratories. The diagnosis of Chronic Kidney Disease was made on the basis of clinical findings and biochemical parameters. Hypertension was defined as an average SBP > 130 mmHg or DBP> 80 mmHg, or self-reported use of anti-hypertensive agents. Presence of diagnosed or undiagnosed diabetes was identified by self-report of diabetes, use of insulin or oral medications for diabetes, or Fasting blood glucose ≥126 mg/dL. Dyslipidaemia was diagnosed was made on self-report of dyslipidaemia, or use of lipid lowering agents. Reporting of cardiovascular diseases was based on both the patient's self-report and review of medical records by trained medical staff. The FRS was calculated using a computer program by a previously suggested algorithm.

SOURCES OF DATA:
The relevant data was collected using a patient profile form designed in such a way that includes all variables required for the study.

SELECTION CRITERIA:

Inclusion Criteria:

1. Patients both male and female above the age of 18 years who are ready to give informed consent are included.
2. Patients diagnosed with chronic kidney disease with and without dialysis.
3. Patients who are diagnosed with cardiovascular diseases as secondary complication in CKD.

Exclusion Criteria:

1. Patients who were not able to give informed consent.
2. Patients under the age of 18 years.
3. Pregnant and lactating women.
4. Patients with viral diseases like HIV and Hepatitis.

STATISTICAL ANALYSIS:
The statistical analysis was performed using IBM SPSS (version 22). Continuous and discrete variables are presented as Mean ± Standard Deviation and frequency with percentage (N (%)), respectively. Data was presented as mean with standard deviation for Normal distribution/scale data and as frequency with proportion N (%) for categorical data. The Chi square test was used to test between group differences. All the statistical analysis is done at 5% significance level or 95% Confidence interval. P values less than 0.05 were regarded as statistically significant.

II. RESULTS AND DISCUSSION:

1. Baseline Characteristics:

Mean age of the study population was 62.21±13.38 years (Mean ±SD) [Table 1]. Majority of the patients were of the age of 61 – 70 years (28.7%) [Figure 3]. The study population consisted of 110 male (73.33%) and 40 female (26.67%) patients [Figure 4]. [Figure 5]

shows Gender specific Age distribution of the patients. Majority of the both male (26.4%) and female (35.0%) patients were of the age group of 61-70 years.

The baseline demographic and baseline clinical characteristics of the study population is are shown in the [Table 1]. The study characteristics included were Age (62.21±13.38), SBP (135.13±24.84), DBP (82.67±14.82), PR (92.30±17.24), RR (21.31±3.30), Serum Creatinine (3.39±1.75), eGFR (40.46±21.79), Blood Urea (89.19±36.99), Serum Sodium (139.15±6.44), Serum Potassium (4.62±0.85), Serum Chloride (105.06±6.44), R.B.S (204.21±96.37), C.R.P (20.18±12.42), Troponin T (191.50±792.68), Troponin I (66.03±378.44), NT-proBNP (9574.14±12368.59) [Table 1].

Variables	Mean	Standard Deviation	Range
Age (years)	62.21	13.38	28 – 88
SBP (mmHg)	135.13	24.84	100 – 220
DBP (mmHg)	82.67	14.82	50 – 130
PR (b.p.m)	92.30	17.24	53 – 150
RR (b.p.m)	21.31	3.30	14 – 40
Serum Creatinine (mg/Dl)	3.39	1.75	0.9 – 10.4
eGFR (mL/min)	40.46	21.79	7 – 96
Blood Urea (mg/Dl)	89.19	36.99	18 – 220
Serum Sodium (mmol/L)	139.15	6.44	114 – 164
Serum Potassium (mmol/L)	4.62	0.85	2.9 – 9.3
Serum Chloride (mmol/L)	105.06	6.44	89 – 119
RBS (mg/Dl)	204.21	96.37	68 – 721
CRP (mg/Dl)	20.18	12.42	0.50 – 48.60
Troponin T (pg/mL)	191.50	792.68	1.26 – 8946
Troponin I (pg/mL)	66.03	378.44	14 – 3832
NT-proBNP (pg/mL)	9574.14	12368.59	181 – 41180

Table 1. Baseline Characteristics of the study population.

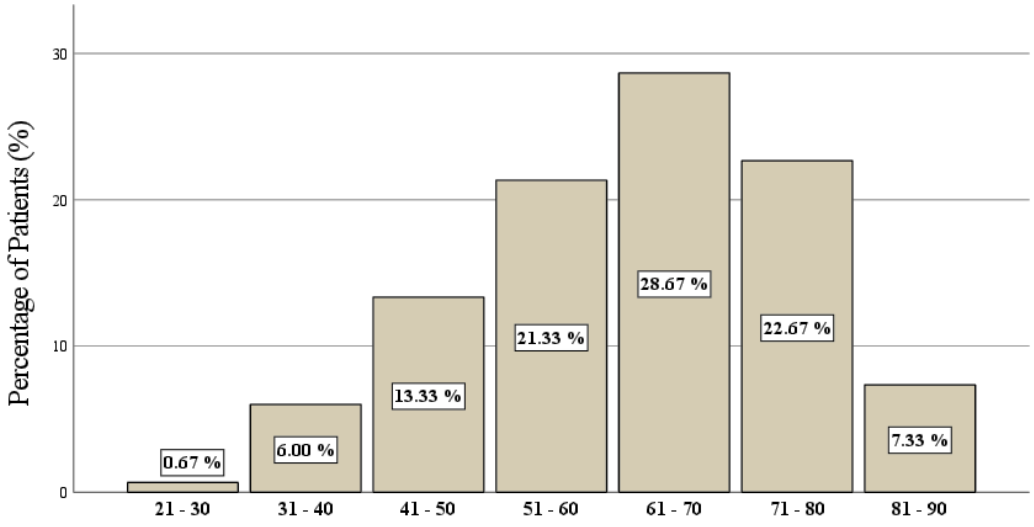

Figure 3. Bar diagram showing Age distribution of the study population.

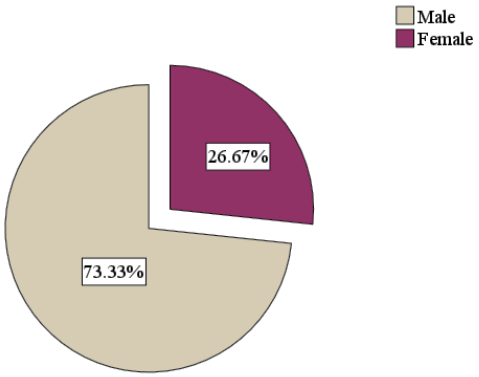

Figure 4. Pie diagram showing Gender distribution of study population.

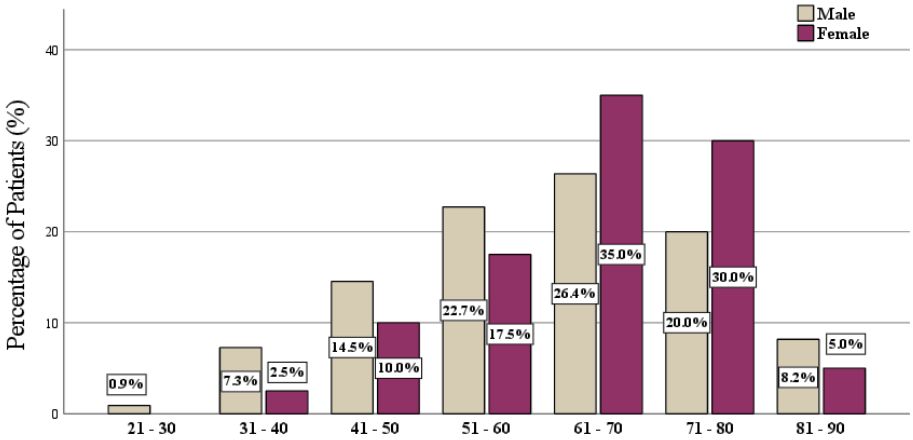

Figure 5. Bar diagram showing Age – Gender distribution of study population.

2. Clinical Findings:

67 out of 150 patients were on dialysis (44.67 %) and 83 out of 150 patients were not on dialysis (55.33%) [Figure 6]. Of all the subjective clinical findings, dyspnoea was the most common symptom, which was present in 122 out of 150 patients (81.3%). Pedal oedema was present in 70 out of 150 patients (46.7%). Chest discomfort was present in 74 patients (49.3%). Decreased urine output was present in 57 patients (38.0%) [Figure 7].

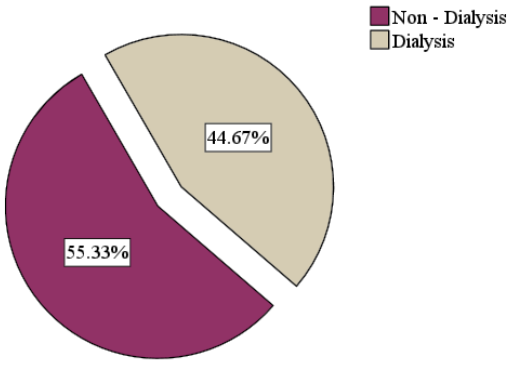

Figure 6. Percentage of Dialysis and Non – Dialysis CKD patients.

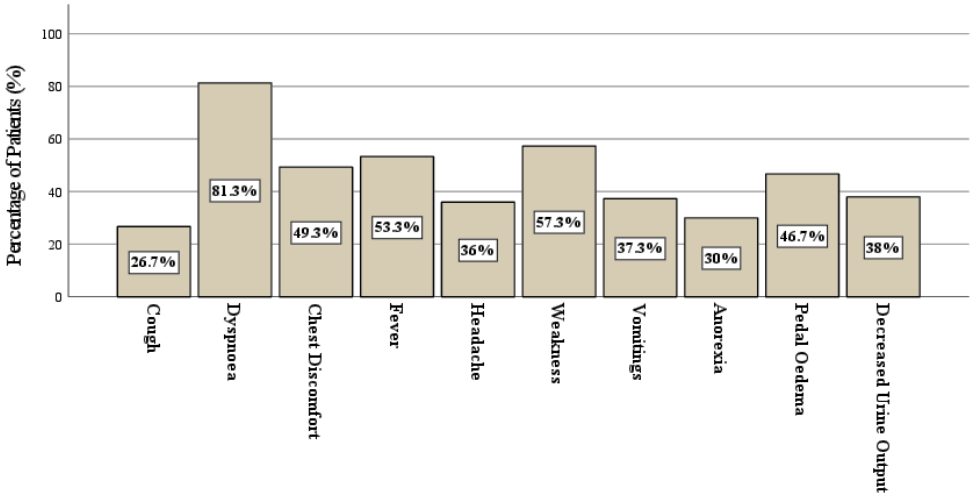

Figure 7. Bar diagram showing clinical findings in CKD patients with secondary CVDs.

3. Prevalence of CV related Co-morbidities:

The prevalence of CV related Co-morbidities was high: 75.33 % had hypertension (n=113), 60.0 % had diabetes (n=90) and 54.67 % (n=82) had dyslipidaemia [Figure 8].

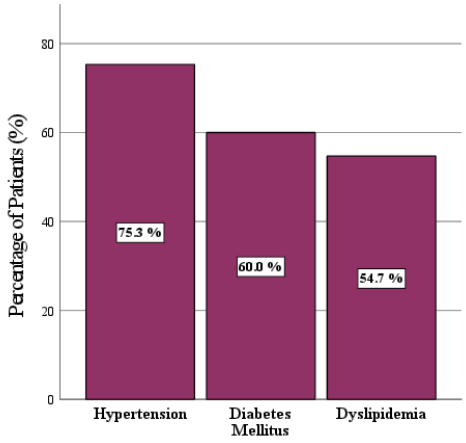

Figure 8. Pie diagram showing Co-morbidities in CKD patients with CVDs.

4. Cardiac manifestations in CKD:

Chest X ray revealed 52 patients had Cardiomegaly (34.7%) and 32 patients had Pulmonary Oedema (21.3%). Echocardiographic findings revealed that MR, TR and AR were present in 129 (86.0%), 111 (74.0%) and 81 (54.0%) patients, which represents Mitral, Tricuspid and Aortic valve abnormalities respectively. LV hypertrophy was present in 107 (71.3%) patients. Pericardial effusion was present in 51 (34.0%) patients. Systolic and diastolic dysfunction were present in 89 (59.3%) and 117 (78.0%) respectively. PAH was present in 89 (59.3%) patients. [Figure 9].

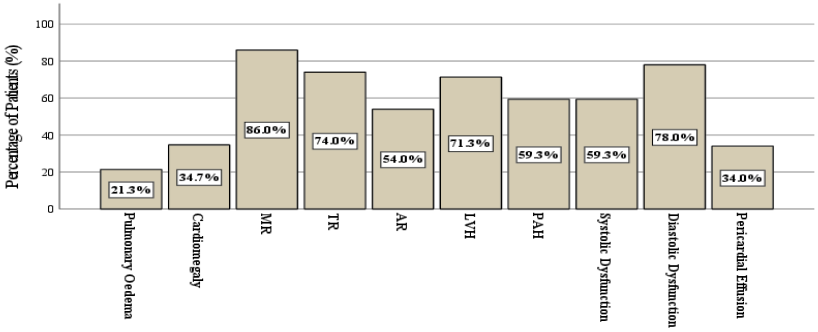

Figure 9. Bar diagram showing Cardiac manifestations in CKD patients with secondary CVDs.

5. Prevalence of Cardiovascular Complications in CKD patients:

The prevalence of heart failure (71.3%) was the highest, followed by CAD (65.3%) and ACS (48.7%) [Figure 10]. Among patients with ACS (n=73), 47 patients had STEMI (64.38%), 13 patients had NSTEMI (17.81%) and 13 patients had Unstable Angina (17.81%) [Figure 11]. Among patients with HF(n=107), 61 patients had HF with preserved Ejection Fraction (HfpEF) (57%) and 46 patients had HF with reduced Ejection Fraction (HfrEF) (43%) [Figure 12]. The prevalence of other CVDs such as, Valvular heart disease (n=68), Cardiomyopathy (n=65), TIA (n=42), CVA (n=30), Ventricular Arrhythmia (n=26), Atrial Fibrillation (n=24), PAD (n=14), Sudden Cardiac Arrest (n=8), were reported to be 45.3%, 43.3%, 28.0%, 20.0%, 17.3%, 16.0%, 9.3% and 5.3%, respectively. CRHD (n=6) was the least prevalent CVD (4.0%) among all the patients. [Figure 10].

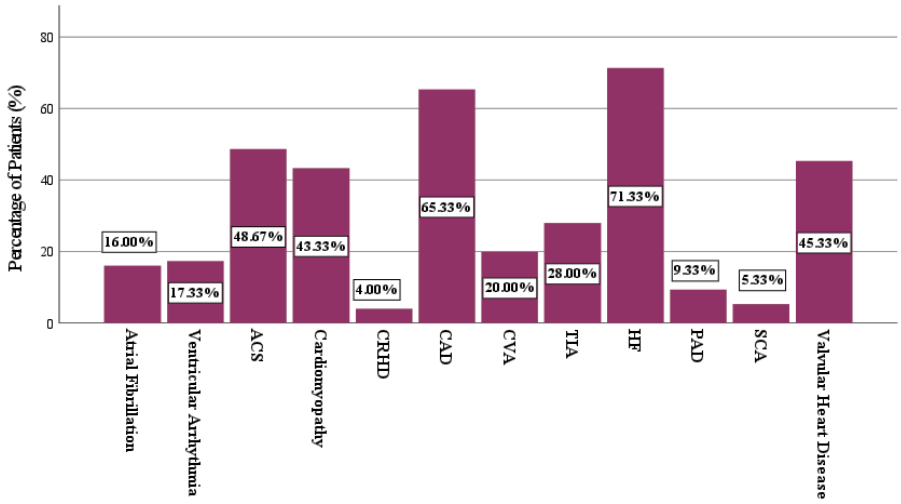

Figure 10. Bar diagram showing various Cardiovascular Complications in CKD patients.

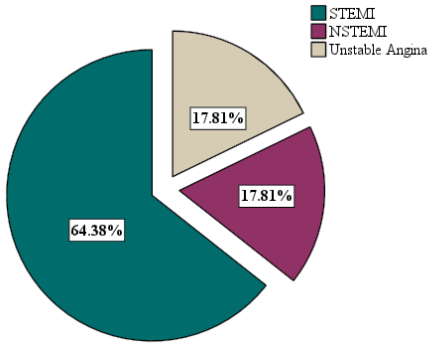

Figure 11. Pie diagram showing different types of Acute Coronary Syndromes.

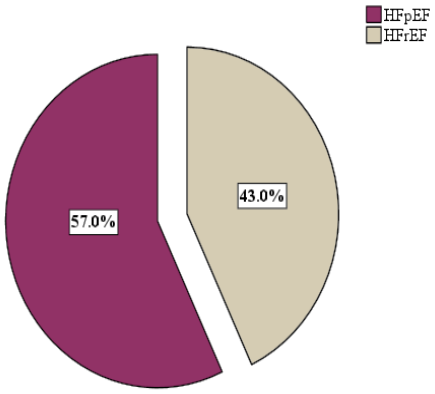

Figure 12. Pie diagram showing different types of Heart Failure in CKD patients.

6. Comparison of CV related Co-morbidities with CV complications in CKD:

The most common CV related co-morbidities in CKD patients were found to be Hypertension, Diabetes Mellitus and Dyslipidaemia. The following data represents the correspondence between the co-morbidities and CV complications in the study population.

6.1. Hypertension:

113 out of 150 patients had Hypertension (75.3%). It was found that there is no significant association between Hypertension and CVDs such as Atrial Fibrillation, Ventricular Arrhythmia and CRHD (P=0.135, P=0.479 and P=0.064 respectively) [Table 2]. Overall, the prevalence of CVDs was higher in patients with versus without hypertension in persons with CKD [Figure 13].

Cardiovascular Disease	Hypertension				Total		P-Value
	Absent (n=37)		Present (n=113)				
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)	
Atrial Fibrillation	5	20.8%	19	79.2%	24	16.0%	0.135
Ventricular Arrhythmia	5	19.2%	21	80.8%	26	17.3%	0.479
ACS	20	27.4%	53	72.6%	73	48.7%	0.045
Cardiomyopathy	13	20.0%	52	80.0%	65	43.3%	0.024
CRHD	1	16.7%	5	83.3%	6	4.0%	0.064
CAD	28	28.6%	70	71.4%	98	65.3%	0.028
CVA	7	23.3%	23	76.7%	30	20.0%	0.017
TIA	8	19.0%	34	81.0%	42	28.0%	0.019
HF	25	23.4%	82	76.6%	107	71.3%	0.038
PAD	7	50.0%	7	50.0%	14	9.3%	0.029
SCA	3	37.5%	5	62.5%	8	5.3%	0.387
Valvular Heart Disease	18	26.5%	50	73.5%	68	45.3%	0.641

Table 2. Comparison of CVDs between 2 groups- with and without hypertension.

6.2. Diabetes Mellitus:

90 out of 150 patients had Diabetes Mellitus (60.0%). It was found that there is no significant association between Diabetes and CVDs such as Atrial Fibrillation, CRHD and SCA (P=0.175, P=0.610 and P=0.182 respectively) [Table 3]. Overall, the prevalence of CVDs was higher in patients with versus without diabetes in persons with CKD [Figure 13].

Cardiovascular Disease	Diabetes Mellitus				Total		P-Value
	Absent (n=60)		Present (n=90)				
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)	
Atrial Fibrillation	12	50.0%	12	50.0%	24	16.0%	0.175
Ventricular Arrhythmia	15	57.7%	11	42.3%	26	17.3%	0.043
ACS	34	46.6%	39	53.4%	73	48.7%	0.019
Cardiomyopathy	21	32.3%	44	67.7%	65	43.3%	0.033
CRHD	3	50.0%	3	50.0%	6	4.0%	0.610
CAD	43	43.9%	55	56.1%	98	65.3%	0.013
CVA	12	40.0%	18	60.0%	30	20.0%	0.024
TIA	15	35.7%	27	64.3%	42	28.0%	0.042
HF	45	42.1%	62	57.9%	107	71.3%	0.017
PAD	6	42.9%	8	57.1%	14	9.3%	0.019
SCA	5	62.5%	3	37.5%	8	5.3%	0.182
Valvular Heart Disease	29	42.6%	39	57.4%	68	45.3%	0.047

Table 3. Comparison of CVDs between 2 groups- with and without diabetes.

6.3. Dyslipidaemia:

82 out of 150 patients had Dyslipidaemia (54.7%). It was found that there is a significant association between Diabetes and CVDs such as Atrial Fibrillation(P=0.016), Ventricular Arrythmia(P=0.038), ACS(P=0.003), Cardiomyopathy(P=0.031), CRHD(P=0.044), CAD(P<0.001), CVA(P=0.007), TIA(P=0.040), HF(P=0.038), PAD(P=0.013), SCA(P=0.042) and Valvular Heart Diseases(P=0.045) [Table 4, Figure 13]. Overall, the prevalence of CVDs was higher in patients with versus without dyslipidaemia in persons with CKD.

Cardiovascular Disease	Dyslipidaemia Absent (n=68)		Present (n=82)		Total		P-Value
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency (%)	Percentage (%)	
Atrial Fibrillation	12	17.6%	12	14.6%	24	16.0%	0.016
Ventricular Arrhythmia	14	20.6%	12	14.6%	26	17.3%	0.038
ACS	24	35.3%	49	59.8%	73	48.7%	0.003
Cardiomyopathy	36	52.9%	29	35.4%	65	43.3%	0.031
CRHD	4	5.9%	2	2.4%	6	4.0%	0.044
CAD	26	38.2%	72	87.8%	98	65.3%	<0.001
CVA	7	10.3%	23	28.0%	30	20.0%	0.007
TIA	15	22.1%	27	32.9%	42	28.0%	0.040
HF	47	69.1%	60	73.2%	107	71.3%	0.038
PAD	7	10.3%	7	8.5%	14	9.3%	0.013
SCA	4	5.9%	4	4.9%	8	5.3%	0.042
Valvular Heart Disease	29	42.6%	39	47.6%	68	45.3%	0.045

Table 4. Comparison of CVDs between 2 groups- with and without dyslipidaemia.

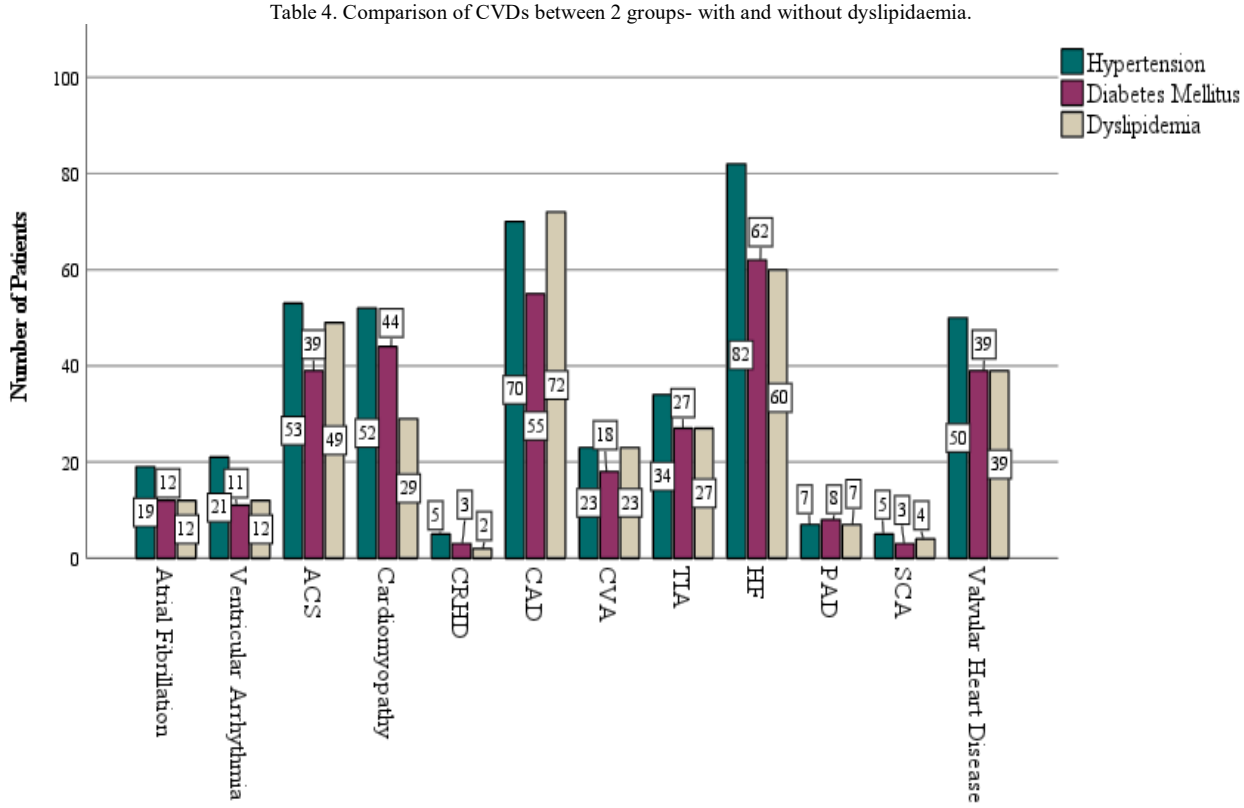

Figure 13. Bar diagram showing comparison of Co-morbidities with various Cardiovascular Complications.

7. Clinical Parameters:

7.1. Renal Function Tests:

Renal Function Tests were performed on 150 patients, out of which abnormal parameters were found to predict CV risk. The results were as follows: 77.3% had abnormal Serum Creatinine (n=116), 96.7% had abnormal eGFR (n=145), 94.0% had abnormal Blood Urea (n=141), 44.0% had abnormal Serum Sodium (n=66), 28.7% had abnormal Serum Potassium (n=43), 51.3% had abnormal Serum Chloride (n=77) and 77.3% had abnormal RBS (n=116). Overall, majority of the patients had abnormal values for RFTs [Figure 14].

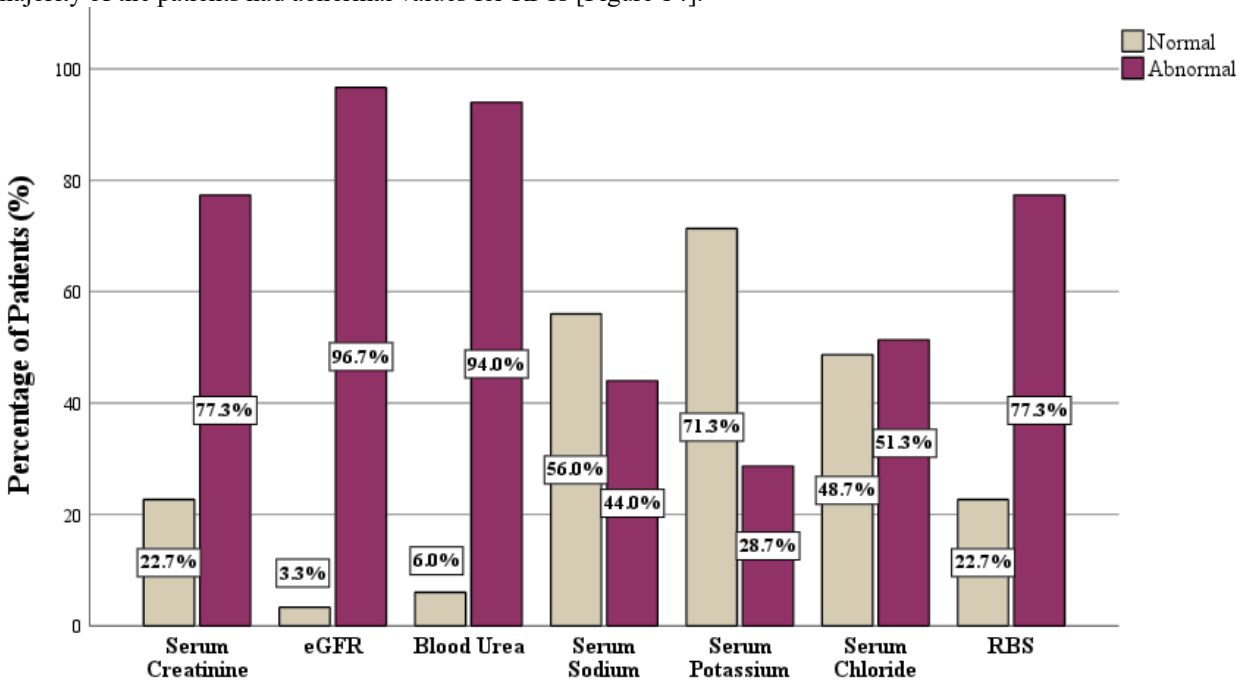

Figure 14. Bar diagram showing comparison of Renal Function Tests in CKD patients with secondary CVDs.

7.2. Cardiac Biomarkers:

Blood Tests were performed on 150 patients for assessment of cardiac biomarkers in CKD patients, out of which abnormal parameters were found to predict CV risk. The results were as follows: 75.3% had abnormal CRP (n=113), 61.3% had abnormal Troponin T (n=92), 24.0% had abnormal Troponin I (n=36) and 68.7% had abnormal NT-proBNP (n=103). Overall, majority of the patients had abnormal values for Cardiac biomarkers [Figure 15].

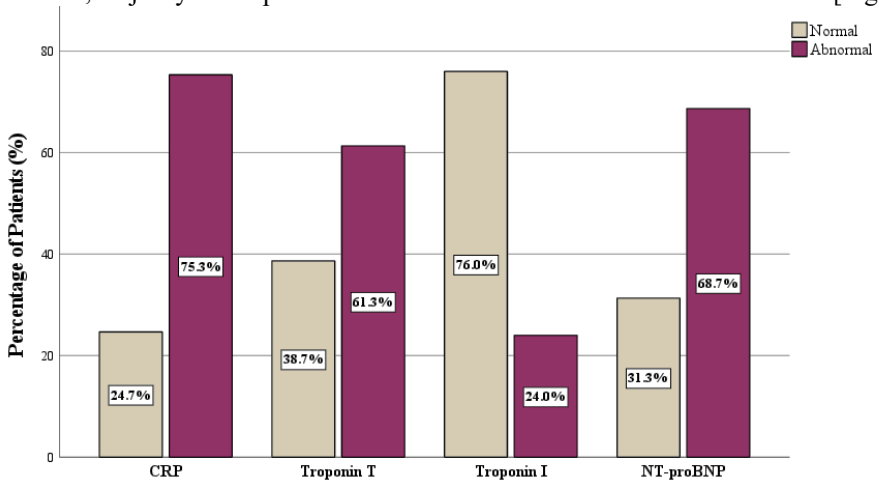

Figure 15. Bar diagram showing results of Cardiac Biomarkers in CKD patients with secondary CVDs.

8. Cardiovascular Risk in CKD:

FRS was used to investigate the risk of CVD. FRS scores were calculated based on the 6 coronary risk factors including Age, Gender, Total Cholesterol, HDL, SBP, and smoking habits. FRS grading was classified into three categories viz. Mild (<10%), Moderate (10-20%) and Severe (>20%). 12.7% of the patients were reported under Mild risk group (n=19), 29.3% of the patients were reported under Moderate risk group (n=44) and 58.0% of the patients were reported under Severe risk group (n=87) [Figure 16]. It was noted that, in CKD patients with the characteristic coronary risk factors, majority of the patients had a significant relation between FRS and CVDs.

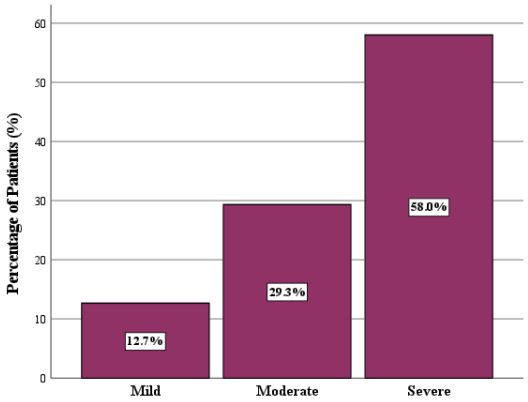

Figure 16. Bar diagram showing grading of Framingham risk score in patients having CVDs secondary to CKD.

FRS was calculated in the study population of 150 patients out of which, 110 were males and 40 were females. The FRS grading in males were reported as 15.45% of Mild (n=17), 29.1% Moderate (n=32) and 55.4% of Severe (n=61) risk groups. The FRS grading in females were reported as 5.0% of Mild (n=2), 30.2% of Moderate (n=12) and 65.0% of Severe (n=26) risk groups [Figure 17].

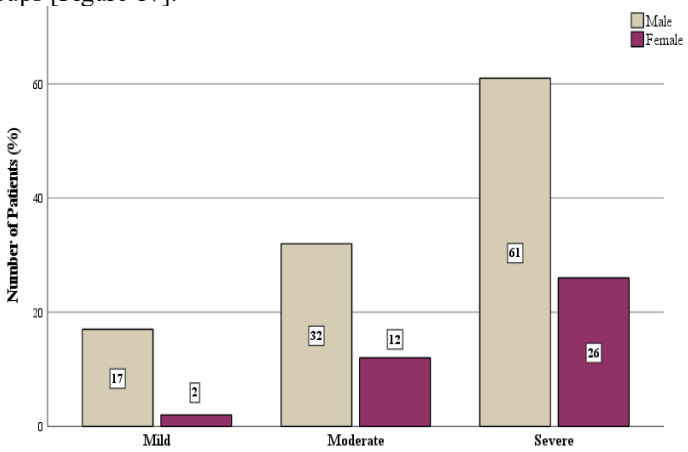

Figure 17. Bar diagram showing grading of Framingham risk score with respect to Gender in patients having CVDs secondary to CKD.

III. CONCLUSION:

This study concludes that Chronic Kidney Disease is a significant risk factor for development of Cardiovascular Diseases. The severity of Chronic Kidney Disease is associated with increased risk of cardiovascular death. In conclusion, the incidence and prevalence of CVDs in Chronic Kidney Disease is high. Cardiovascular related co-morbidities in CKD have a significant role in development of CVDs in Chronic Kidney Disease patients. Effective treatment and management of cardiovascular risk factors should be employed in high-risk patients amongst CKD population, with aggressive management of hypertension, hyperglycaemia and dyslipidaemia along with smoking cessation. Thereby, early detection and appropriate treatment along with appropriate lifestyle modifications should be instituted early to slow disease progression and help in prevention of Cardiovascular deaths in CKD patients. In future, further research is needed in this area of study to identify unique, non-traditional risk factors that contribute to accelerated disease progression to optimize the quality of life in CKD patients.

IV. LIST OF ABBREVIATIONS:

S.NO.	ABBREVIATION	FULLFORM
1	ACS	Acute Coronary Syndrome
2	AF	Atrial Fibrillation
3	AKI	Acute Kidney Injury
4	AMI	Acute Myocardial Infraction
5	AR	Aortic Regurgitation
6	ARF	Acute Renal Failure
7	AVF	Arteriovenous Fistula
8	BP	Blood Pressure
9	BUN	Blood Urea Nitrogen
10	CAD	Coronary Artery Disease
11	CHD	Congenital Heart Disease
12	CKD	Chronic Kidney Disease
13	CRF	Chronic Renal Failure
14	CRHD	Chronic Rheumatic Heart Disease
15	CRP	C-Reactive Protein
16	CRS	Cardiorenal Syndrome
17	CV	Cardiovascular
18	CVA	Cerebrovascular Accident
19	CVD	Cardio Vascular Disease
20	DBP	Diastolic Blood Pressure
21	DM	Diabetes Mellitus
22	eGFR	Estimated Glomerular Filtration Rate
23	ESRD	End Stage Renal Disease
24	FRS	Framingham Risk Score
25	GFR	Glomerular Filtration Rate
26	HD	Haemodialysis
27	HDL	High Density Lipoprotein
28	HF	Heart Failure
29	HfpEF	Heart Failure with Preserved Ejection Fraction
30	HfrEF	Heart Failure with Reduced Ejection Fraction
31	HTN	Hypertension
32	IHD	Ischemic Heart Disease
33	IV	Intravenous
34	LVH	Left Ventricular Hypertrophy
35	MR	Mitral Regurgitation
36	NSTEMI	Non-ST segment Elevation Myocardial Infraction
37	PAD	Peripheral Arterial Disease
38	PAH	Pulmonary Artery Hypertension
39	PTH	Parathyroid Hormone
40	RAAS	Renin Angiotensin Aldosterone System
41	RHD	Rheumatic Heart Disease
42	RRT	Renal Replacement Therapy
43	SBP	Systolic Blood Pressure
44	SCA	Sudden Cardiac Arrest
45	STEMI	ST segment Elevation Myocardial Infraction
46	TIA	Transient Ischaemic Attack
47	TR	Tricuspid Regurgitation

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