STM JOURNALS

Research & Reviews: A Journal of
Life Sciences

https://journals.stmjournals.com/rrjols/

ISSN: 2249–8656 (Online)
ISSN: 2348–9545 (Print)
Volume 14, Issue 3, 2024
DOI (Journal): 10.37591/RRJoLS

Research RRJoLS

A Study on the Incidence and Prevalence of Cardiovascular Morbidity and Mortality in Patients Undergoing Maintenance Hemodialysis

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Abstract

Cardiovascular Disease (CVD) is a major complication for patients with end-stage renal disease (ESRD) on Hemodialysis (HD), with the mortality rate from CVD being nearly 20 times higher than in the general population. As Chronic Kidney Disease (CKD) advances, patients accumulate both traditional and kidney-specific cardiovascular risk factors, such as hypertension, diabetes, fluid overload, electrolyte imbalances, and uremic toxins. These factors contribute significantly to the increased cardiovascular morbidity and mortality in this group. This study aimed to assess the incidence, prevalence, and variety of cardiovascular manifestations among CKD patients receiving maintenance hemodialysis (MHD) and to identify key risk factors for cardiovascular events in this population. A cross-sectional observational study was conducted with 50 CKD patients on MHD, with data collected through personal interviews using a structured questionnaire. The questionnaire included various parameters associated with cardiovascular outcomes in this group. Key assessments involved Electrocardiography (ECG), 2D Echocardiography, Stress Thallium Test, Stress Echocardiography, and Treadmill Test (TMT). Results indicated a high prevalence of hypertension and diabetes among the participants. Cardiovascular manifestations were common and diverse within the cohort, indicating a significant cardiovascular burden among patients undergoing MHD. CKD patients on MHD showed a high prevalence of CVD, with hypertension and diabetes as prominent risk factors. These findings underscore the importance of thorough cardiovascular evaluation and management for improving outcomes and reducing cardiovascular events in this high-risk population.

Keywords: Cardiovascular disease, chronic kidney disease, cardiovascular risk factors, cardiovascular morbidity, cardiovascular risk factors, diabetes

INTRODUCTION

Cardiovascular diseases (CVDs) are the leading cause of death globally, claiming approximately 17.9 million lives each year. These diseases encompass a variety of heart and blood vessel disorders, such as coronary heart disease, cerebrovascular disease, and rheumatic heart disease. Heart attacks and strokes account for more than 80% of CVD-related fatalities, with a considerable portion occurring in people under 70. CVDs are particularly prevalent among dialysis patients, affecting about 60% of individuals in this group, where it stands as the primary cause of mortality, responsible for nearly 40% of deaths in maintenance hemodialysis (MHD) patients. Declining kidney function leads to the buildup of uremic toxins, which impair cellular function and contribute to cardiovascular damage [1].

In MHD patients, sudden cardiac death, chest pain, fatigue, and edema are common symptoms,

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Received Date: October 08, 2024
Accepted Date: November 18, 2024
Published Date: November 26, 2024

Citation: Iqtisam Mushtaq Bhat, Ibtisam Nazir Khan, Pankaj Kaul. A Study on the Incidence and Prevalence of Cardiovascular Morbidity and Mortality inPatients Undergoing Maintenance Hemodialysis. Research & Reviews: A Journal of Life Sciences. 2024; 14(3): 56–66p.

significantly reducing quality of life. Cardiovascular events contribute more to mortality than issues related to renal failure itself, with CVD death rates in MHD patients being 10–20 times higher than in the general population. About 80% of MHD patients have at least one CVD form at the onset of dialysis, often due to pre-existing conditions like diabetes, hypertension, obesity, and smoking. Other risk factors include age, chronic kidney disease, and inflammatory conditions [2].

Diabetes mellitus, a primary risk factor, has driven an increase in patients requiring renal replacement therapy, with cardiovascular complications significantly impacting mortality [3]. Hypertension affects a large proportion of dialysis patients and increases cardiovascular strain, further heightening risks. Anemia, which can exacerbate left ventricular hypertrophy, is also prevalent. Additionally, fluid overload from reduced urine output raises cardiac workload, leading to hypertension, left ventricular hypertrophy, and heart failure. This study evaluates the incidence and prevalence of cardiovascular morbidity and mortality in MHD patients, addressing the urgent need to mitigate these risks [4].

Aims and Objectives

Aim of the Study

To study the incidence and prevalence of cardiovascular morbidity and mortality in patients undergoingmaintenance Hemodialysis.

Objectives of the Study

1. To ascertain the incidence, prevalence, demographic and the spectrum of variouscardiovascular manifestations in the subgroup of CKD patients undergoing MHD.
2. To identify the risk factors which may have a contributory role for various cardiovascularevents in patients undergoing MHD.

Materials and Methods

Study Design

A cross-sectional observational study was conducted at Meliora Kidney and Urology Institute, Paras Hospital (Panchukla), and Shalby Hospital (Mohali), all accredited by NABH for MHD. The study included 50 patients undergoing hemodialysis for at least six months. Data was collected through personal interviews using a pre-designed questionnaire to assess cardiovascular outcomes in CKD patients on MHD [5].

Study Participants and Inclusion Criteria

- Patients aged 18 years and above.
- Patients with ESRD on maintenance hemodialysis.
- CKD patients who had a kidney transplant but were on MHD for at least 3 months before the transplant (retrospective data included).

Exclusion Criteria

- CKD patients on peritoneal dialysis.
- Patients are under 10 or over 80 years of age.
- Patients with a history of coronary artery disease prior to CKD onset.

Data Collection

Patients were interviewed, and clinical data was recorded, including symptoms related to CVD, medical history, and clinical examination. Relevant investigations (ECG, 2D ECHO, stress thallium test, stress ECHO, TMT, and coronary angiography) were documented [6].

Ethical Considerations and Confidentiality

Informed consent was obtained from all participants, ensuring confidentiality and privacy throughout the study [7].

RESULTS

Demographics

Gender Distribution

The study included a cohort of 50 patients undergoing MHD, characterized by a distribution ofgender, with 66% being male and 34% being female patients, which was more predominant inmales as compared to females. The ratio was 2:1 (Table 1 and Figure 1).

Table 1. Gender Distribution of Patients undergoing MHD.

Gender Distribution	%
Male	66%
Female	34%

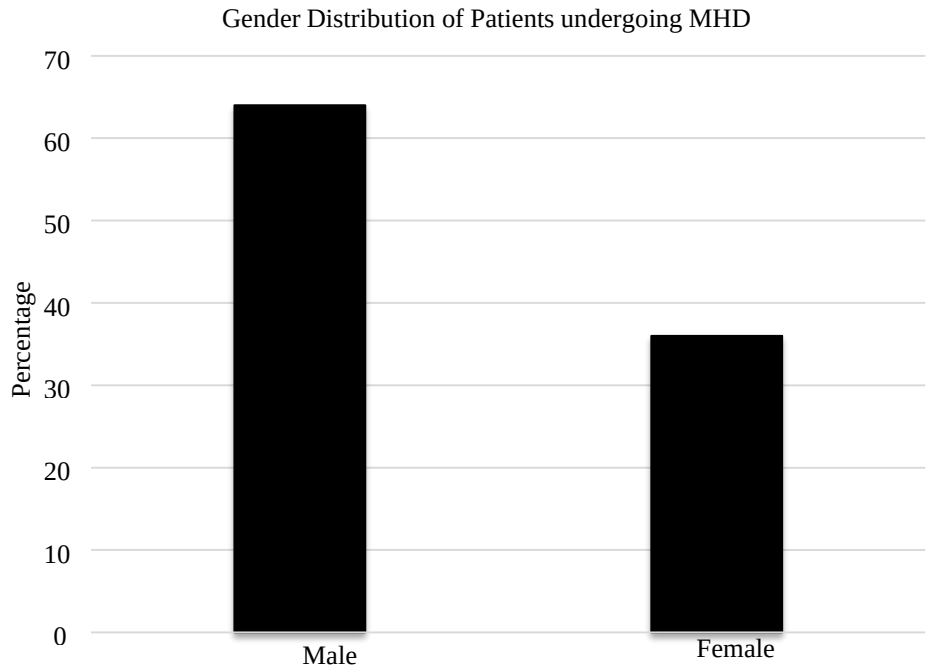

Figure 1. Gender Distribution of Patients undergoing MHD.

Age Group Distribution

In our study cohort of 50 patients undergoing MHD, the age distribution indicates CKD is more prevalent in older age groups. In our study cohort of 50 patients undergoing MHD, the age distribution indicates that CKD is more prevalent in older age groups. The 20–30 and 30–40 agegroups were equally represented, with 3 patients (12%) in each group, making them the smallestrepresentation in the study. The proportion of 26% fell within the 40-50 age range, comprising 13 patients. The 50–60 age group compromised, with 8 patients making up 16%. The 60–70 and 70–80 age groups followed closely, each accounting for 22% of the total 11 patients each. Overall, 31 patients (62%) were above 50 years old, making this the largest age group in the study. This age distribution highlights the strong correlation between increasing age and the prevalence of CKD. As individuals age, they are more likely to develop CKD due to the naturaldecline in renal function, the cumulative burden of comorbidities, such as hypertension and diabetes, and prolonged exposure to various nephrotoxic factors. Consequently, most patients in our study were over the age of 50, reflecting the increased risk and incidence of CKDin the elderly population (Figure 2 and Table 2) [8–10].

Spectrum of Time Period of MHD

54% of patients underwent dialysis for 0–6 months, while none had it for 6–12 months. 28% were on dialysis for 1–2 years, 14% for 2–6 years, and 4% for over 6 years. Most patients, constituting 54%,

had dialysis for less than 6 months, and the next highest group, representing 28%, underwent it for 1–2 years. Notably, no patients fell within the 6–12 months duration category (Table 3) [11].

Table 2. Age Distribution of patients undergoing MHD.

Age Group (Years)	N	%
20–30	3	12%
30–40	3	12%
40–50	13	26%
50–60	8	16%
60–70	11	22%
70–80	11	22%
80–90	1	2%

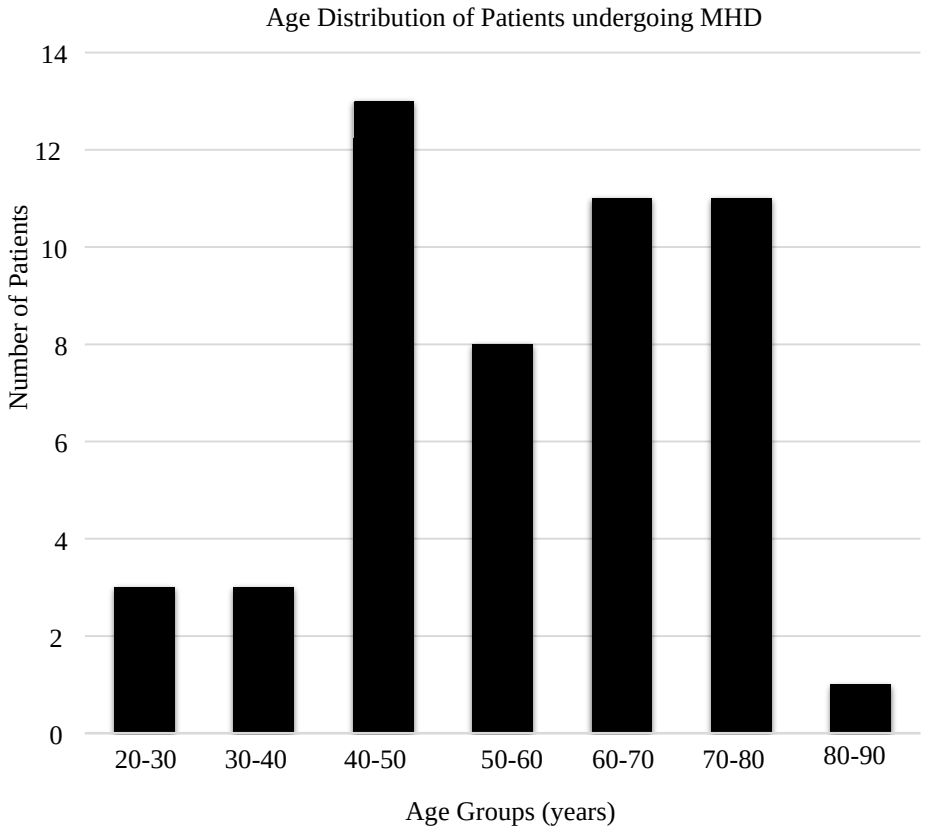

Figure 2. Age Distribution of Patients undergoing MHD.

Table 3. Distribution of Patients by Duration of MHD.

Duration of Dialysis	%
0–6 Months	54%
6–12 Months	0%
1–2 Years	28%
2–6 Years	14%
Above 6 Years	4%

Etiology of CKD

Among 50 patients on maintenance hemodialysis (MHD), 49% had hypertension, significantly increasing cardiovascular risks like heart failure and stroke. Diabetes affected 43%, contributing to

CKD and cardiovascular complications. Other conditions included chronic glomerulonephritis (2%), interstitial nephritis (3%), polycystic kidney disease (2%), and urological issues (1%) (Figure 3).

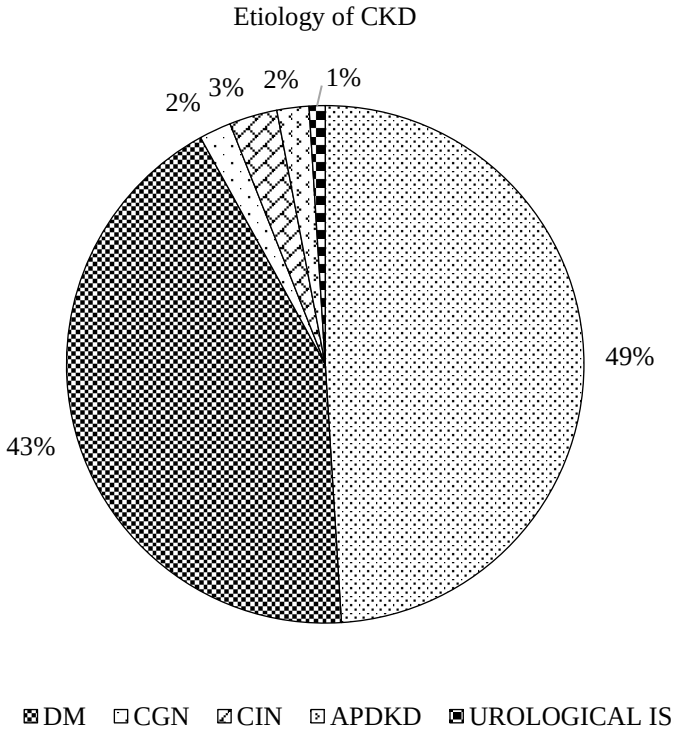

Figure 3. Etiology of CKD.

Prevalence of Contributing Factors

In 50 MHD patients, 84% have diabetes, 94% hypertension, and 56% experience blood pressure fluctuations. The group includes 64% males, 34% smokers, 14% alcohol consumers, and 94% with a sedentary lifestyle. Additional factors include family cardiovascular history (22%), elevated triglycerides (34%), and high cholesterol (20%) (Table 4 and Figure 4).

In this sample, 20% of individuals experienced cardiovascular events, while no cerebrovascular accidents (strokes) were reported. Despite this positive absence, vigilant management of stroke risk factors, such as hypertension, atrial fibrillation, and atherosclerosis, remain crucial. Peripheral vascular disease (PVD) affected 10% of patients, presenting as conditions impacting blood vessels outside the heart and brain, often in the legs and feet, and can lead to symptoms like limb pain, claudication, and poor wound healing (Table 5 and Figure 5) [12].

CAD Presentation

In the study, 18% of CAD patients experienced stable angina, 30% had shortness of breath, and 8% had myocardial infarction. Anemia was present in 86% of patients. Angina may occur during dialysis due to increased cardiovascular strain, while shortness of breath suggests cardiac dysfunction or fluid overload in MHD patients (Figures 6–7 and Table 6) [13].

Correlation Between CAD Event and Risk Factors

Among patients with coronary artery disease (CAD), 38% have hypertension, a known risk factor that promotes atherosclerosis and myocardial infarction. 33% have diabetes, which accelerates atherosclerosis and increases CAD risk. 14% experience intradialytic blood pressure fluctuations, exacerbating cardiovascular stress. 12% are smokers, contributing to endothelial dysfunction and atherosclerosis. 4% consume alcohol, which, when excessive, increases cardiovascular risk. 32% have elevated cholesterol levels, which promotes plaque formation and increases CAD risk. 18% have high

triglycerides, contributing to endothelial dysfunction and inflammation. 2% have a family history of CAD, indicating genetic predisposition, and 16% are anemic (Tables 7–8 & Figure 8) [14, 15].

Table 4. Prevalence of contributing factors.

Variables	**Category**		
		N	***%***
Sex	Male	33	66
	Female	17	34
Age	20–30	3	6
	30–40	3	6
	40–50	13	26
	50–60	8	16
	60–70	11	22
	70–80	11	22
	80–90	1	2
HTN	Yes	47	94
	No	3	6
DM	Yes	42	84
	No	8	16
Variation in Intradialytic Pressure	Yes	28	56
	No	22	44
TG	Yes	17	34
	No	33	66
Smoking	Yes	17	34
	No	33	66
Alcohol	Yes	7	14
	No	43	86
Sedentary lifestyle	Yes	47	94
	No	3	6
Family history	Yes	11	22
	No	39	78

Table 5. Profile of CVD events.

CVD Events	**N**	**%**
CAD	10	20%
CVD	0	0%
VSDs	5	10%

Table 6. Presentation of CAD.

CAD PRESENTATION		**Male**		**Female**		**Total**	
		N	***%***	***N***	***%***	***N***	***%***
Angina	Yes	6	12	3	6	9	18
	No	27	54	14	28	41	82
Shortness of Breath	Yes	10	20	5	10	15	30
	No	23	46	12	24	35	70
Myocardial Infarction	Yes	2	4	2	4	4	8
	No	31	62	15	30	46	92
ANAEMIA	Yes	27	54	16	32	43	86
	No	6	12	1	2	7	14

Among CAD patients, 38% had hypertension, 33% had diabetes, 14% experienced intradialytic blood pressure fluctuations, and 12% were smokers. 4% consumed alcohol, 32% had elevated cholesterol, 18% had high triglycerides, 2% had a family history of cardiovascular disease, and 16% were anemic, all contributing to CAD risk.

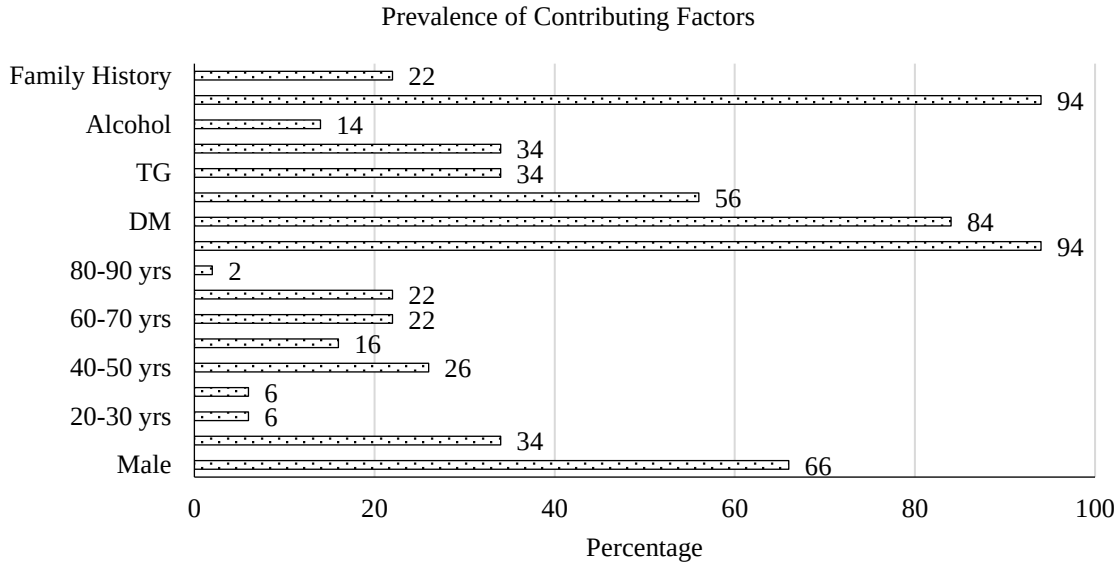

Figure 4. Prevalence of contributing factors profile of CVD events.

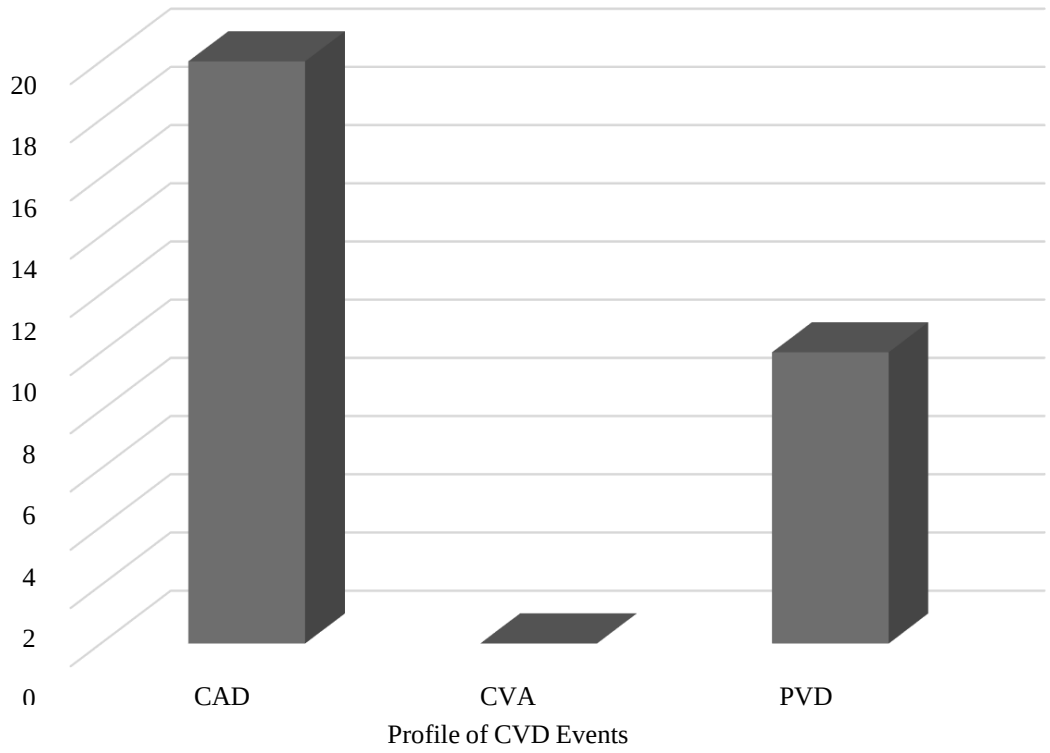

Figure 5. Graphical representation of CVD event.

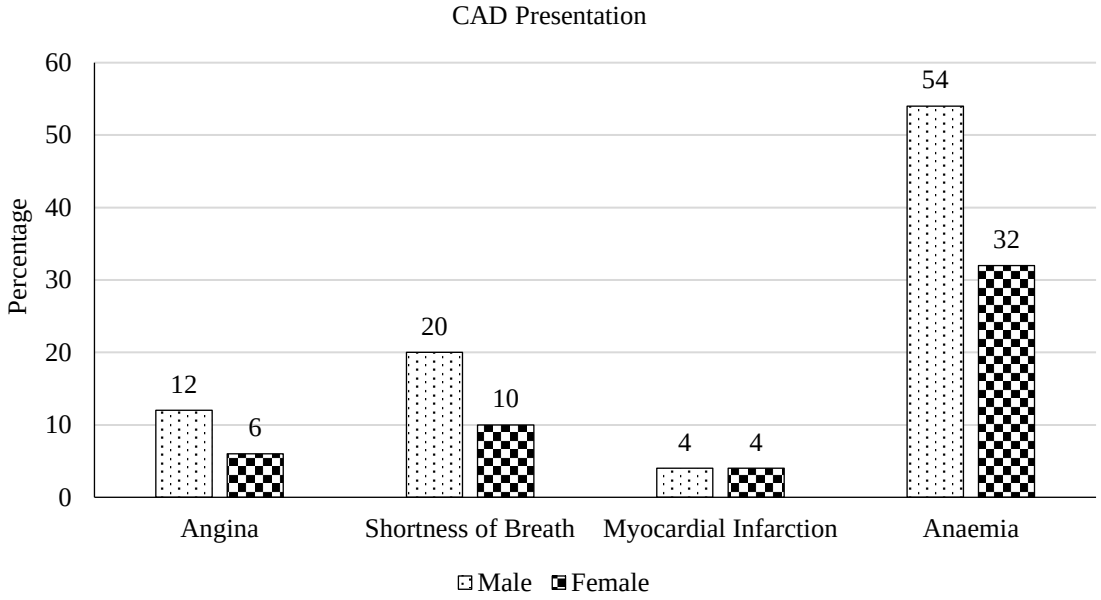

Figure 6. Profile of CVD events.

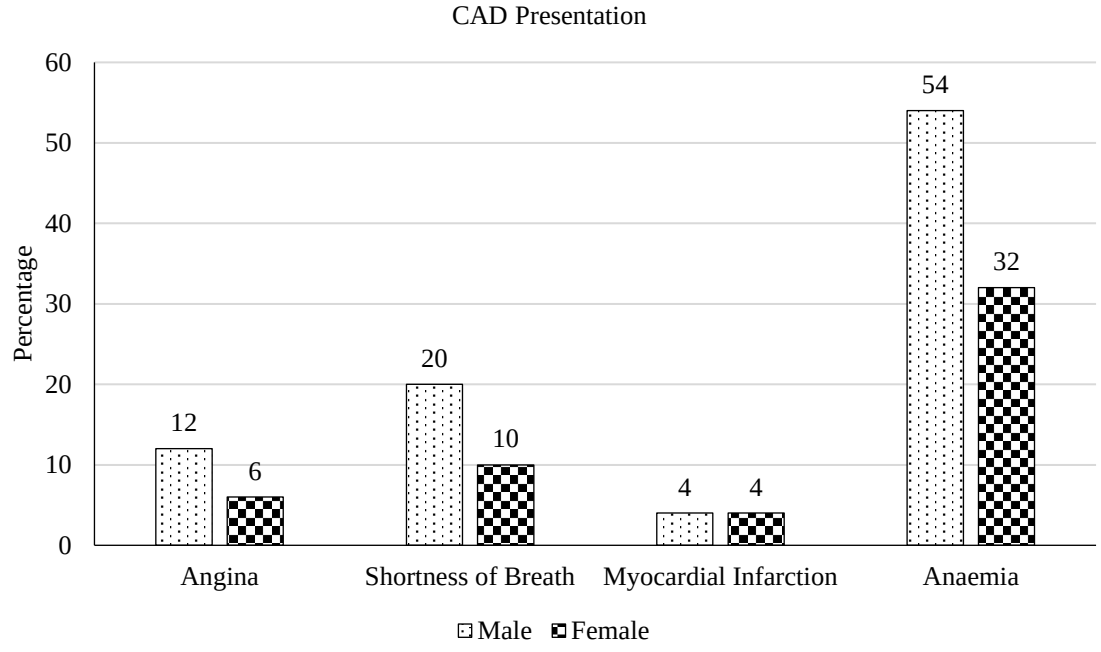

Figure 7. Presentation of CAD.

DISCUSSION

Cardiovascular conditions are the leading cause of mortality in CKD patients, especially those undergoing MHD, significantly impacting quality of life. Our study of 50 patients revealed a male predominance (66%) and a high prevalence of hypertension (96%) and diabetes (84%) [16, 17]. A significant portion (56%) experienced intradialytic blood pressure fluctuations, and 94% led a sedentary lifestyle. Anemia was prevalent in 86% of the cohort, with a notable gender difference in severity. CVD was present in 20%, with 12% of diabetic patients also having CAD. The study highlights the complex interplay of comorbidities and the need for comprehensive cardiovascular management in MHD patients [18].

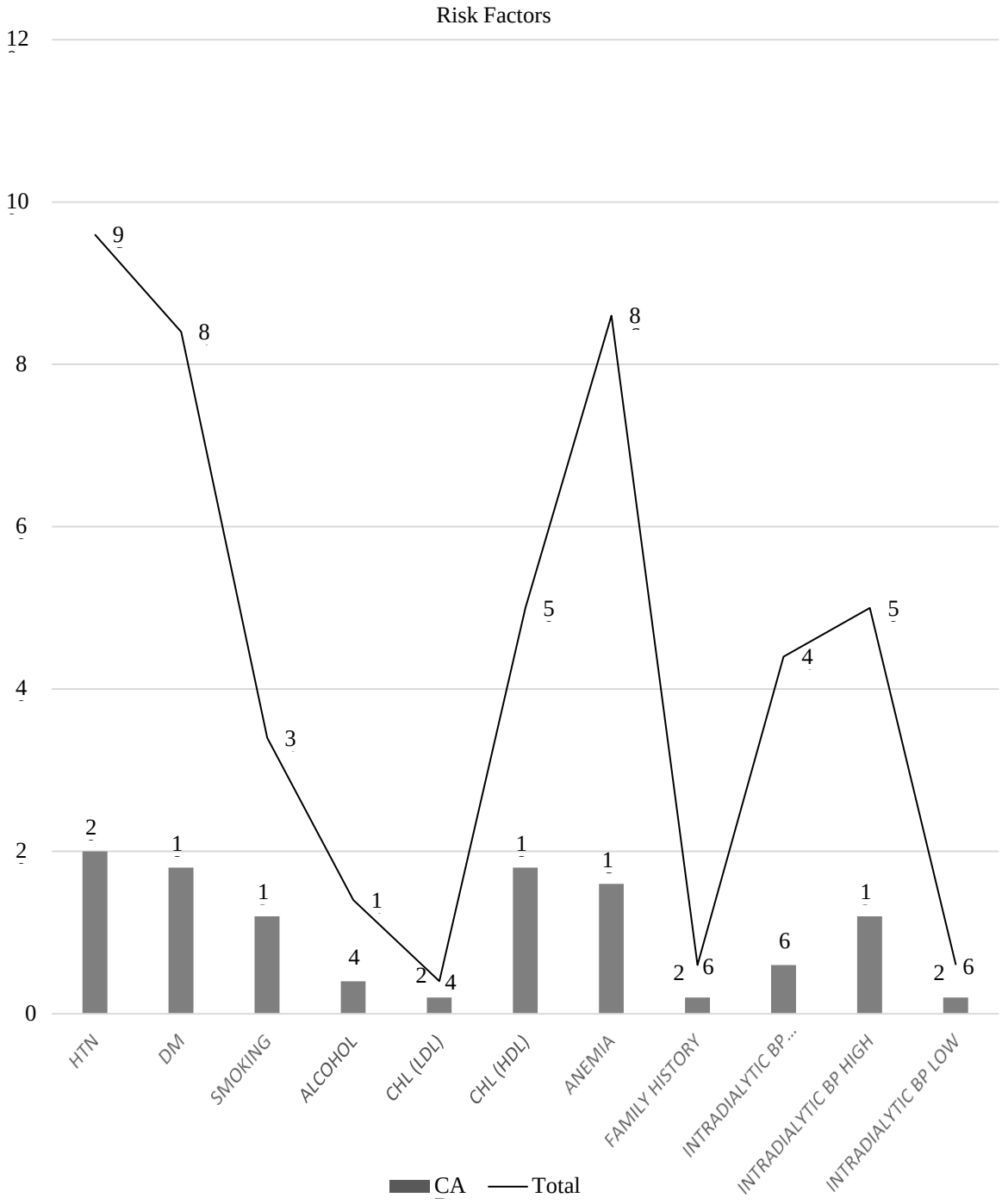

Figure 8. Correlation between CAD events and risk factors.

CONCLUSIONS

Our study highlights the cardiovascular burden in CKD patients undergoing MHD, with hypertension and diabetes as key risk factors. Despite a lower prevalence of CVD than some studies, cardiovascular events remain a major concern. Comorbidities like anemia, peripheral vascular disease, and lifestyle factors, such as smoking and sedentary behavior exacerbate risks. The relationship between anemia and coronary artery disease further complicates management. However, the study's limited sample size and lack of comprehensive diagnostic tests may have led to an underestimation of certain conditions. Future research with larger, longitudinal studies is essential to enhance understanding and improve cardiovascular care in this population.

Table 7. Correlation between CAD events and risk factors.

Risk Factors	Category	CAD Event				Total	
		Yes		*No*			
		N	*%*	*No*	*%*	*N*	*%*
HTN	Yes	10	20	38	76	48	96
	No	0	0	2	4	2	4
DM	Yes	9	18	33	66	42	84
	No	1	2	7	14	8	16
Intradialytic BP	Normal	3	6	19	38	22	44
	High	6	12	19	38	25	50
	Low	1	2	2	4	3	6
Smoking	Yes	6	12	11	22	17	34
	No	4	8	29	58	33	66
Alcohol	Yes	2	4	5	10	7	14
	No	8	16	35	70	43	86
CHL (LDL)	Yes	1	2	1	2	2	4
	No	9	18	39	78	48	96
CHL (HDL)	Yes	6	18	19	38	25	50
	No	4	8	21	42	25	50
Anemia	Yes	8	16	35	70	43	86
	No	2	4	5	10	7	14
Family History	Yes	1	2	2	4	3	6
	No	9	18	38	76	47	94

Table 8. Demographics and Baseline characteristics of the study population (n = 50).

N		Minimum	Maximum	Mean	Std. Deviation
Age	50	21.00	86.00	57.1000	15.14858
Pulse	50	70.00	116.00	85.5800	11.59537
Systolic BP	50	100	170	139.84	18.080
Diastolic BP	50	55	110	79.06	10.108
Triglycerides	50	60.00	450.00	207.9600	88.96364
Haemoglobin	50	5.30	12.20	9.3880	1.49961
Cholesterol LDL	50	29.60	134.20	77.6074	24.23854
Cholesterol HDL	50	16.00	55.00	37.8800	8.42164

REFERENCES

1. Foley RN, Parfrey PS, Sarnak MJ. Epidemiology of cardiovascular disease in chronic renal disease. J Am Soc Nephrol. 1998 Dec 1;9(12 Suppl):16–23.
2. Stack AG, Bloembergen WE. Prevalence and clinical correlates of coronary artery disease among new dialysis patients in the United States: A cross-sectional study. J Am Soc Nephrol. 2001 Jul 1;12(7):1516–23.
3. Foley RN, Parfrey PS. Cardiac disease in chronic uremia: clinical outcome and risk factors. Adv Renal Replace Ther. 1997 Jul 1;4(3):234–48.
4. Cheung AK, Sarnak MJ, Yan G, Berkoben M, Heyka R, Kaufman A, et al. Cardiac diseases in maintenance hemodialysis patients: Results of the HEMO Study. Kidney Int. 2004 Jun 1;65(6):2380–9.
5. Collins AJ, Foley RN, Chavers B, Gilbertson D, Herzog C, Johansen K, et al. US Renal Data System 2011 annual data report. Am J Kidney Dis. 2012 Jan 1;59(1):A7.
6. Bello AK, Johnson DW, Feehally J, Harris D, Jindal K, Lunney M, et al. Global Kidney Health

Atlas GKHA: design and methods. Kidney Int Suppl. 2017 Oct 1;7(2):145–53.
7. Bello AK, Levin A, Tonelli M, Okpechi IG, Feehally J, Harris D, et al. Assessment of Global Kidney Health Care Status. AGKHCS. Jama. 2017 May 9;317(18):1864–81.
8. Locatelli F, Pozzoni P, Del Vecchio L. Renal replacement therapy in patients with diabetes and end-stage renal disease. J Am Soc Nephrol. 2004 Jan 1;15(1_suppl):25–9.
9. Le Feuvre C, Borenstein M, Beygui F, Helft G, Batisse JP, Metzger JP. Comparison of short-and long-term outcomes of coronary angioplasty in patients with and without diabetes mellitus and with and without hemodialysis. Am J Cardiol. 2003 Sep 15;92(6):721–5.
10. Trespalacios FC, Taylor AJ, Agodoa LY, Abbott KC. Incident acute coronary syndromes in chronic dialysis patients in the United States. Kidney Int. 2002 Nov 1;62(5):1799–805.
11. Metra M, Cannella G, La Canna G, Guaini T, Sandrini M, Gaggiotti M, et al.. Improvement in exercise capacity after correction of anemia in patients with end-stage renal failure. Am J Cardiol. 1991 Oct 15;68(10):1060–6.
12. Klahr S, Levey AS, Beck GJ, Caggiula AW, Hunsicker L, Kusek JW, et al. The effects of dietary protein restriction and blood-pressure control on the progression of chronic renal disease. New Eng J Med. 1994 Mar 31;330(13):877–84.
13. Buckalew Jr VM, Berg RL, Wang SR, Porush JG, Sally R, Schulman G. Modification of Diet in Renal Disease Study Group. Prevalence of hypertension in 1,795 subjects with chronic renal disease: the modification of diet in renal disease study baseline cohort. Am J Kidney Dis. 1996 Dec 1;28(6):811–21.
14. Rocco MV, Flanigan MJ, Beaver S, Frederick P, Gentile DE, McClellan WM, et al. Report from the 1995 core indicators for peritoneal dialysis study group. Am J Kidney Dis. 1997 Aug 1;30(2):165–73.
15. Fishbane S, Natke E, Maesaka JK. Role of volume overload in dialysis-refractory hypertension. Am J Kidney Dis. 1996 Aug 1;28(2):257–61.
16. Venkatesan J, Henrich WL. Anemia, hypertension, and myocardial dysfunction in end-stage renal disease. In Seminars in Nephrology. 1997 Jul 1;17(4)257–269.
17. Silberberg JS, Rahal DP, Patton DR, Sniderman AD. Role of anemia in the pathogenesis of left ventricular hypertrophy in end-stage renal disease. Am J Cardiol. 1989 Jul 15;64(3):222–4.
18. Macdougall IC, Coles GA, Williams JD, Davies ME, Hutton RD, Cochlin DL, et al. Long-term cardiorespiratory effects of amelioration of renal anaemia by erythropoietin. The Lancet. 1990 Mar 3;335(8688):489–93.

