

# A study on hypertension management in patients on maintenance hemodialysis

Liz Elizabeth Antony<sup>\*1</sup>, Manjunath J Kulkarni<sup>2</sup> and Venkatesha B.M.<sup>3</sup>

<sup>1</sup>Resident, Department of Medicine, Father Muller Medical College, Mangalore – 575002, India

<sup>2</sup>Professor, Department of Nephrology, Father Muller Medical College, Mangalore – 575002, India

<sup>3</sup>Professor, Department of Medicine, Father Muller Medical College, Mangalore – 575002, India

## QR Code



## \*Correspondence Info:

Dr. Liz Elizabeth Antony  
Resident,  
Department of Medicine,  
Father Muller Medical College,  
Mangalore – 575002, India

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## Abstract

A longitudinal study was done on 50 CKD patients on maintenance haemodialysis on antihypertensive drugs. Hypertension in patients affected by CKD has been recognized as one of the major classical cardiovascular risk factors. The study aims to describe the class and number of drugs used for management of hypertension in patients on maintenance haemodialysis and to measure blood pressure and assess how many patients have achieved target blood pressure. On an average 42% of patients had adequate BP control and 58% were found not to have adequate BP control. The most commonly used antihypertensive BP medications being calcium channel blockers- amlodipine and alpha agonist – clonidine followed by beta blockers- metoprolol and the most frequently used drug combination being amlodipine with clonidine. Weight reduction to achieve adequate dry weight for adequate BP control was found to be at range of 2-3kgs.

**Keywords:** CKD, maintenance haemodialysis, antihypertensive drugs, blood pressure, target BP.

## 1. Introduction

The prevalence of hypertension in patients undergoing haemodialysis is about 86%. Although these patients receive antihypertensive treatment about 30% have well controlled blood pressure (BP) and 12% have untreated hypertension. [3] The study aims to find out the most commonly used antihypertensive drugs used and the number of drugs used and required in attaining the target BP.

### 1.1 Review of Literature

Majority of ESRD (End stage renal disease) patients on dialysis are hypertensive. The morbidity and mortality in dialysis patients is cardiovascular disease accounts for 50% of deaths. [1, 3]

Prognosis of CKD by GFR and albuminuria categories: KDIGO 2012				Persistent albuminuria categories description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30–300 mg/g 3–30 mg/mmol	>300 mg/g >30 mg/mmol
GFR categories (ml/min/1.73 m <sup>2</sup> ) description and range	G1	Normal or high	≥90			
	G2	Mildly decreased	60–89			
	G3a	Mildly to moderately decreased	45–59			
	G3b	Moderately to severely decreased	30–44			
	G4	Severely decreased	15–29			
G5	Kidney failure	<15				

Adapted from KDIGO Int Suppl 2013; 3[5-14]

GFR (Glomerular filtration rate) <15ml/min/1.73m<sup>2</sup> requiring renal replacement therapy is termed ESRD/Kidney failure.

Chronic kidney disease (CKD) is also referred as a vasculopathic state, due to the accelerated atherosclerosis and arteriosclerosis seen in these patients. [2]

Hypertension in CKD according to American Society of Hypertension (ASH), American Society of Nephrology (ASN), European Society of Cardiology (ESC), European Society of Hypertension (ESH) is defined on basis of home (HBPM) or 24 hour ambulatory BP monitoring (ABPM) during a mid-week dialysis interval. Home BP measurements ≥135/85mmHg both for CKD patients and for patients on hemodialysis. Twenty four hour ambulatory BP ≥130/80mmHg for CKD patients and ≥135/85mmHg for hemodialysis patients.

When neither ABPM nor home BP measurements are applicable, conventional BP measurement taken during the dialysis intervals are taken for diagnosis and management of hypertension. At variance with pre dialysis BP which has an U shaped relationship with mortality, the average of 3 office BP measurements is taken. The threshold of office BP ≥140/90mmHg for hemodialysis patients. [4]

Hypertension in patients affected by CKD has been recognized as one of the major classical cardiovascular risk factors. [1, 3] Adequate control of hypertension in ESRD patients can reduce the morbidity and mortality.

**1.2 Aim and objectives**

- 1) To describe the class and number of drugs used for management of hypertension in patients on maintenance haemodialysis
- 2) To measure blood pressure and assess how many patients have achieved target blood pressure.

**1.3 Implication of study:** To study the drug usage pattern in dialysis patients.

- Will guide management of new patients.

**2. Materials and methods**

**Study design:** Longitudinal study

**Source of study:** ESRD patients on haemodialysis in Father Muller Medical College dialysis unit

**Study Size:** 50 ESRD patients on haemodialysis

**Study duration:** - 1month

**Methods:**

**Inclusion criteria:** all ESRD patients on maintenance haemodialysis at FMMCH dialysis unit.

**Exclusion criteria:** Children less than 18 years

- Patients diagnosed with diabetes

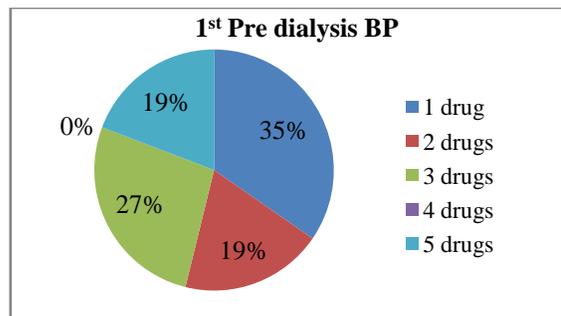
All patients on maintenance haemodialysis after obtaining informed consent, blood pressure recordings pre and post dialysis, weight pre and post dialysis are recorded and these parameters are recorded on following 2 dialysis.

The antihypertensive medications patient is currently on are noted.

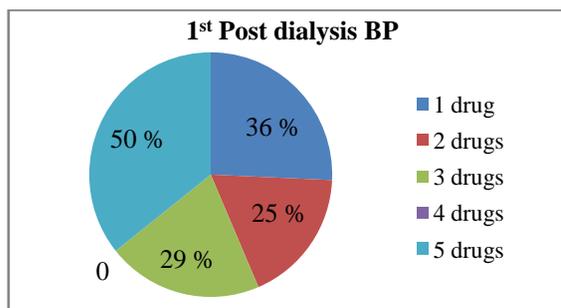
**Ethical clearance number:** FMMCIEC/CCM/363/2018

**Statistical analysis:** Paired T test, Chi square test

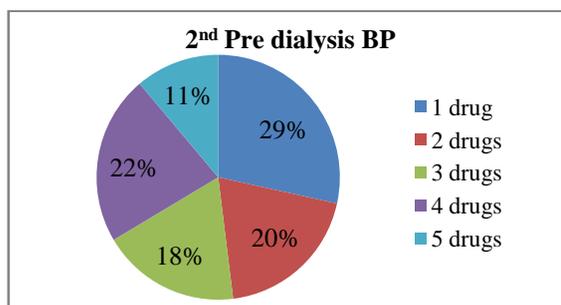
**3. Results**



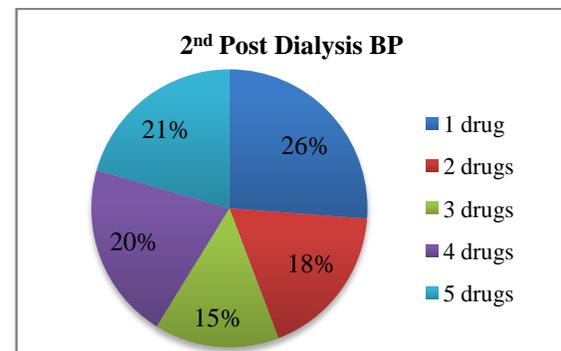
**Figure 1:** Pie chart showing 1<sup>st</sup> pre dialysis BP, 32% patients were found to have adequate BP control with the number of anti-hypertensive drugs



**Figure 2:** Pie charts showing 1<sup>st</sup> post dialysis BP, 30% patients were found to have adequate BP control with the number of anti-hypertensive drugs



**Figure 3:** Pie chart showing 2<sup>nd</sup> pre dialysis BP, 46% patients were found to have adequate BP control with the number of anti-hypertensive drugs



**Figure 4:** Pie chart showing 2<sup>nd</sup> posts dialysis BP, 46% patients were found to have adequate BP control with the number of anti-hypertensive drugs

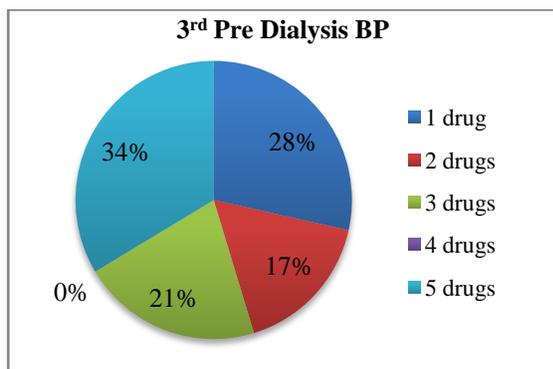


Figure 5: Pie chart showing 3<sup>rd</sup> pre dialysis BP, 48% patients were found to have adequate BP control with the number of anti-hypertensive drugs

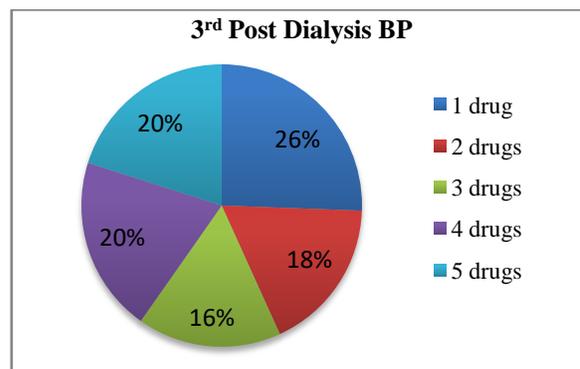


Figure 6: Pie chart showing 3<sup>rd</sup> post dialysis BP, 48% patients were found to have adequate BP control with the number of anti-hypertensive drugs

Table 1: comparing weight reduction with adequate BP control Chi square test – comparing weight reduction with adequate BP control – significance for 3<sup>rd</sup> pre-dialysis BP with a p value <0.005

		Weight reduction			
		<2 kgs	2-3 kgs	3-4 kgs	>4 kgs
		Count	Count	Count	Count
DIALYSIS 1 Pre dialysis BP(mmHg)	>140/90	5	0	6	23
	<=140/90	7	0	6	3
DIALYSIS 1 Postdialysis BP(mmHg)	>140/90	7	0	8	20
	<=140/90	5	0	4	6
DIALYSIS 2 Predialysis BP(mmHg)	>140/90	4	3	15	5
	<=140/90	7	9	5	2
DIALYSIS 2 Postdialysis BP(mmHg)	>140/90	0	5	17	5
	<=140/90	11	7	3	2
DIALYSIS 3 Predialysis BP(mmHg)	>140/90	5	3	12	6
	<=140/90	10	10	1	3
DIALYSIS 3 Postdialysis BP(mmHg)	>140/90	7	5	9	5
	<=140/90	8	8	4	4

Table 3: Mean BP readings with number of anti- hypertensive drugs

	1 Drug		2 Drug		3 Drug		4 Drug		5 Drug	
	Mean	SD								
Dialysis 1 Pre dialysis BP (systolic)	148.18	25.62	151.25	22.77	146.47	27.14	180	14.14	162.5	30.96
Dialysis 2 Post dialysis BP (systolic)	142.73	23.28	151.88	23.44	157.06	26.64	180	0	152.5	26.3
Dialysis 2 Pre dialysis BP (systolic)	137.27	23.7	156.25	26.3	155.88	23.2	155	21.21	157.5	25.00
Dialysis 2 Post dialysis BP (systolic)	130.91	20.71	148.75	19.2	151.18	21.18	150	14.14	150.00	41.63
Dialysis 3 Pre dialysis BP (systolic)	140.91	20.71	148.13	15.59	147.06	19.93	170	0	155.00	30.00
Dialysis 3 Post dialysis BP (systolic)	139.09	15.78	144.38	22.5	157.06	24.94	160	28.28	152.5	18.93
Dialysis 1 Pre dialysis BP (diastolic)	81.82	10.72	85.00	14.61	85.29	8.00	90	14.14	77.5	9.57
Dialysis 1 Post dialysis BP (diastolic)	80.91	11.36	87.5	11.25	81.76	7.28	95	7.07	87.5	5.00
Dialysis 2 Pre dialysis BP (diastolic)	84.55	6.88	86.87	8.73	87.06	9.2	85	7.07	85.00	5.77
Dialysis 2 Post dialysis BP (diastolic)	78.18	8.74	88.13	8.34	84.12	9.39	90	0	85.00	12.91
Dialysis 3 Pre dialysis BP (diastolic)	84.55	5.22	86.25	9.57	84.71	7.17	95	7.07	87.5	9.57
Dialysis 3 Post dialysis BP (diastolic)	82.73	7.86	86.25	10.25	88.24	9.51	85	7.07	85.00	5.77
Dialysis 1 Pre dialysis MBP	155.91	22.45	160.63	22.72	158.53	19.67	180	21.21	158.75	23.23
Dialysis 1 Post dialysis MBP	152.27	20.05	163.44	20.06	160.29	18.66	185	7.07	163.75	16.52
Dialysis 2 Pre dialysis MBP	153.18	17.36	165.00	20.25	165.00	19.04	162.5	17.68	163.75	13.15
Dialysis 2 Post dialysis MBP	143.64	16.9	162.5	16.43	159.71	15.86	165	7.07	160.00	27.08
Dialysis 3 Pre dialysis MBP	155.00	12.25	160.31	13.84	158.24	14.46	180	7.07	165.00	23.8
Dialysis 3 Post dialysis MBP	152.27	14.72	158.44	19.72	166.76	20.99	165	21.21	161.25	14.36

SD: Standard Deviation

Table 4: Antihypertensive drug class and number of patients on the drug

Antihypertensive drug class	Number of patients on the drug
α antagonist	11
α agonist	25
β antagonist	22
ARB's (Angiotensin II receptor blockers)	1
ACEI's (Angiotensin converting enzyme inhibitor)	0
Vasodilator	10
Calcium Channel Blocker	45
Diuretics	8

## 5. Discussion

This study was done on 50 CKD patients on maintenance haemodialysis. On an average pre dialysis BP was in control for 42% of the patients.

As per chart 1 among 50 CKD on maintenance hemodialysis receiving antihypertensive treatment for the 1<sup>st</sup> pre dialysis only 32% of the patients were found to have adequate BP control of which 45% was with use of a single anti-hypertensive drug, 35% with 3 anti-hypertensive drugs, 25% with 2 anti-hypertensive drugs and 25% with 5 anti-hypertensive drugs.

As per chart 3 for the 2<sup>nd</sup> pre dialysis 46% of the patients were found to have adequate BP control of which 63.6% was with use of single anti-hypertensive drug, 50% with 4 anti-hypertensive drugs, 43.8% with 2 anti-hypertensive drugs, 41.2% with 3 anti-hypertensive drugs and 25% with 5 anti-hypertensive drugs.

As per chart 5 for the 3<sup>rd</sup> pre dialysis – 48% of the patients were found to have adequate BP control of which 63.6% was with use of single anti-hypertensive drug, 75% with 5 anti-hypertensive drugs, 47.1% with anti-hypertensive drugs, and 37.5% with 2 anti-hypertensive drugs.

On an average post dialysis BP was in control for 41% patients. As per chart 2 for the 1<sup>st</sup> post dialysis only 30% of the patients were found to have adequate BP control of which 50% was with use of 5 anti-hypertensive drugs, 36% with 1 anti-hypertensive drug, 29% with 3 anti-hypertensive drugs and 25% with 2 anti-hypertensive drugs.

As per chart 4 for the 2<sup>nd</sup> post dialysis – 46% of the patients were found to have adequate BP control of which 63.6% was with use of single anti-hypertensive drug, 50% with 4 anti-hypertensive drugs, 50% with 5 anti-hypertensive drugs, 43.8% with 2 anti-hypertensive drugs, and 35.3% with 3 anti-hypertensive drugs.

As per chart 6 for 3<sup>rd</sup> post dialysis – 48% of the patients were found to have adequate BP control of which 63.6% was with use of single anti-hypertensive drug, 50% with 4 anti-hypertensive drugs, 50% with 5 anti-hypertensive drugs, 43.8% with 2 anti-hypertensive drugs, and 41.2% with 3 anti-hypertensive drugs.

Regarding the number of antihypertensive drugs, among the 50 CKD patients on maintenance haemodialysis 22% of patients were on 1 anti-hypertensive drug, 32% of patients were on 2 anti-hypertensive drugs, 34% were on 3 anti-hypertensive drugs, 4% were on 4 anti-hypertensive drugs and 8% were on 5 anti-hypertensive drugs.

It was observed that there was no relation between adequate BP control and the number of antihypertensive drugs being used. Other observational studies such as studies by Inker *et al* [6], Klag *et al* [7] show a direct relationship between level of blood pressure and progression of renal disease.

Table 4 shows the most commonly use antihypertensive drugs. The most common being calcium channel blockers - Amlodipine, followed by alpha agonist - Clonidine, beta antagonist - Metoprolol, alpha antagonist - Prazosin. The most commonly used drug combination being Amlodipine and Clonidine. A study done by Ahmad *et al* [8] showed that a combination of Amlodipine and Clonidine was the most frequently prescribed antihypertensive drugs. Amlodipine with beta-blockers provided best control of blood pressure in these patients.

It was observed from the study that patients with significant weight gain in the interdialysis period had poor BP control. Patients with less than 2kg weight reduction with dialysis didn't attain adequate BP control. Table 1 shows the comparison of weight reduction with adequate BP, chi square test showed a significance with a p value of <0.005 at range of 2-3kgs weight reduction with dialysis. A study done by Inrig[90] says that first line intervention is sodium retention and adequate sodium removal during dialysis to attain a adequate dry weight and then the antihypertensive agents are used to attain adequate BP control.

## 6. Conclusion

This is an observational study which did not show any correlation between the numbers of antihypertensive drugs being used necessary to achieve adequate BP control. On an average 42% of patients had adequate BP control and 58% were found not to have adequate BP control. The most commonly used antihypertensive BP medications being calcium channel blockers- Amlodipine and alpha agonist – Clonidine followed by beta blockers- Metoprolol and the most frequently used drug combination being Amlodipine with clonidine. Weight reduction to achieve adequate dry weight for adequate BP control was found to be at range of 2-3kgs.

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