



General Medicine

INTRADIALYTIC ADVERSE EFFECT OF MAINTENANCE HAEMODIALYSIS IN CHRONIC KIDNEY DISEASE PATIENTS.

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ABSTRACT **Background:** haemodialysis was the most common kidney replacement therapy. It was associated with both acute and chronic complications. **Objectives** To find out the adverse events during the maintenance haemodialysis in chronic kidney disease patients. **Material and Methods:** This observational study was done in 2023 among 160 patients undergoing maintenance hemodialysis at Sri Venkateshwara Medical College Hospital and Research Institute, Pondicherry. The study was conducted after the approval of the Institutional Ethics Committee of Sri Venkateshwara Medical College Hospital and Research Institute, Pondicherry. The inclusion criteria were patients above the age of 18 years and End-stage renal disease patients undergoing maintenance hemodialysis at least twice a week. Informed consent was obtained from all the participants included in the study. **Results:** 39% of the participants reported having at least one complication. 31.6% had hypotension as a complication followed by 27.5% with muscle cramps. 12.2% had fever and chills and 10.2% had headache. 8.1% reported to have nausea and vomiting. Hypoglycaemia developed in 4.1% and hypertension in 3.1%. Chest pain was reported by 2.1% and catheter tip migration in 1.1%. Among those in whom hypotension was a complication, 67.7% had diabetes mellitus followed by 16.1% with chronic glomerulonephritis. Among those with muscle cramps, 63% had hypertension followed by 18.5% with diabetes. **Conclusion:** Four in ten who had undergone haemodialysis had at least one complication. The common complication is hypotension followed by muscle cramps,

KEYWORDS : Haemodialysis, adverse event, hypotension, muscle cramps, hypoglycaemia, hypertension, headache

INTRODUCTION

When the renal damage i.e., eGFR <60 ml/1.73m²/min persists for more than 3 months it is termed as chronic kidney disease¹. The present trends in the prevalence of chronic kidney disease show a constant rise in the proportion of people suffering from it. The global prevalence of CKD is currently around 11 to 13%². CKD is ranked as the third most common cause of death. It was projected that by the year 2040, CKD will become the fifth leading cause of years of life lost^{3,4}. The increasing trend of CKD could be due to the increasing trend shown in the diseases that lead to kidney damage like hypertension, diabetes, renal stones and glomerular diseases. The increased usage of over-the-counter medications could also lead to chronic kidney disease. The management of end-stage renal disease (ESRD) is either renal transplantation or dialysis. Dialysis can be either hemo or peritoneal⁵. Dialysis takes a period of either 3 or 4 hours. The frequency of dialysis was about twice or thrice in a week⁶.

Haemodialysis is both the commonest form of Kidney replacement therapy (KRT) and dialysis, globally⁷. Haemodialysis though a valid treatment for CKD, was also associated with high rates of mortality and morbidity^{8,9}. One of the reasons for high mortality was said to be the presence of comorbidities like peripheral vascular disease, chronic obstructive pulmonary disease, cardiovascular disease and cerebrovascular disease among patients undergoing haemodialysis. Haemodialysis can cause various complications which can be categorised into acute and chronic. Acute complications occur either during the session or immediately after it¹⁰.

The most frequent acute complications include hypotension followed by arrhythmias and muscle cramps. The other acute ones include nausea, vomiting, headache, back pain, fever and chills alongside hypertension^{11,12}. The present study was done to find out the adverse events during the maintenance haemodialysis in chronic kidney disease patients. Similar studies were not conducted in the study setting before. The study will aid in understanding the type of complications in the study setting.

MATERIAL AND METHODS

This observational study was done in 2023 among 160 patients undergoing maintenance hemodialysis at Sri Venkateshwara Medical College Hospital and Research Institute, Pondicherry. The study was conducted after the approval of the Institutional Ethics Committee of Sri Venkateshwara Medical College Hospital and Research Institute, Pondicherry. The inclusion criteria were patients above the age of 18

years and End-stage renal disease patients undergoing maintenance hemodialysis at least twice a week. Exclusion criteria include patients not on maintenance hemodialysis at least twice a week, known cases of other kidney diseases like acute kidney injury, nephrotic syndrome, renal cell carcinoma, and patients who were not willing to participate. Informed consent was obtained from all the participants included in the study.

Data was collected using investigator-made proforma after referring to standard sources. The age of the patients in completed years was recorded. The sex of the patient was noted down as either male or female. The cause of chronic kidney disease was taken note of from the records. All the patients participating in the study were observed for 3 consecutive hemodialysis. In the first hemodialysis session observed, the purpose of the study was explained to the patients, and consent was obtained. At the beginning of the hemodialysis, a brief history of the patient, weight, blood pressure, pulse rate, haemoglobin, blood urea, and serum creatinine were recorded. The patient was checked for any intradialytic adverse effects between the hemodialysis sessions. Blood pressure and weight were re-recorded at the end of every dialysis session.

The data collected were entered into Microsoft Excel 2019 for the creation of a master chart. The master chart was then loaded onto SPSS version 26 for statistical analysis. All the variables were qualitative in nature and expressed using frequency and percentages. About inferential statistics, the chi-square test was used to compare the distribution between two qualitative variables. A P value of less than 0.05 was considered to be statistically significant.

RESULTS

During the study period, 160 patients underwent hemodialysis for end-stage renal disease. 42.5% were of age more than 60 years followed by 33.7% in 46 to 60 years. 55.6% were males. The access device was AV fistula in 71.2% of participants and catheter access was in 28.8% of participants. In 47.5% the cause was diabetes followed by 27.5% where the cause was hypertension. The other causes included chronic glomerulonephritis (10%), bilateral small-size kidneys (6.3%) and renal stones (5.6%) (Table 1). 61% of the participants reported to have at least one complication (Fig 2).

31.6% had hypotension as a complication followed by 27.5% with muscle cramps. 12.2% had fever and chills and 10.2% had headache. 8.1% reported to have nausea and vomiting. Hypoglycemia developed

in 4.1% and hypertension in 3.1%. Chest pain was reported by 2.1% and catheter tip migration in 1.1% (Table 2). All the factors of age, sex and type of access were found to be equally distributed among those with and without intradialytic complications with a P value of more than 0.05 (Table 3). Among those in whom hypotension was a complication, 67.7% had diabetes mellitus followed by 16.1% with chronic glomerulonephritis. Among those with muscle cramps, 63% had hypertension followed by 18.5% with diabetes. Among those who had reported fever and chills, 58.3% had diabetes and 25% had hypertension, among those who had reported headache, 40% had hypertension and 30% had diabetes (Table 4).

DISCUSSION

Haemodialysis is both the commonest form of Kidney replacement therapy (KRT) and dialysis, globally⁷. Haemodialysis though a valid treatment for CKD, it was also associated with high rates of mortality and morbidity^{8,9}. Haemodialysis can cause various complications which can be categorised into acute and chronic. Acute complications occur either during the session or immediately after it¹⁰.

The present study was observational carried out in 2023 among 160 patients undergoing maintenance hemodialysis at Sri Venkateshwara Medical College Hospital and Research Institute, Pondicherry. The study was conducted after the approval of the Institutional Ethics Committee of Sri Venkateshwara Medical College Hospital and Research Institute, Pondicherry. Informed consent was obtained from all the participants included in the study. Those fulfilling the inclusion and exclusion criteria were included in the study.

In the present study, 39% of the participants reported to have at least one complication. 31.6% had hypotension as a complication followed by 27.5% with muscle cramps. 12.2% had fever and chills and 10.2% had headache. 8.1% reported to have nausea and vomiting. Hypoglycemia developed in 4.1% and hypertension in 3.1%. Chest pain was reported by 2.1% and catheter tip migration in 1.1%. Ali M et al also reported a similar pattern with regard to the complications that occurred during dialysis¹³. The result was consistent with that of Mohamood A et al¹⁴. A Netherlands review reported hypotension as the commonest complication during haemodialysis¹⁵.

Hemodialysis being a life-saving procedure in end-stage renal disease it comes with its complications the most common being hypotension. The pathophysiology behind the development of hypotension is mainly attributed to the replacement of large blood volume and electrolytes over a short period which triggers many compensatory mechanisms mainly cardiac and venous reflexes. SUlowocz W and Radiszewski reported that the reduction in blood volume and extracellular osmolality at the time of diagnosis leads to a decrease in blood pressure levels among the patients¹⁶.

Muscle cramps in hemodialysis patients occurred due to excessive ultrafiltration, electrolyte-mineral imbalance, and hypoosmolality. Stewart WK et al proposed muscle cramps could be due to plasma volume contraction¹⁷. Fever and chills occurred due to vascular line infection and membrane incompatibility. Headache occurred due to rapid fluid shifting and dilatation of blood vessels. Nausea and vomiting occurred due to hypotension and high dialysate fluid. Hypoglycemia occurred in diabetic patients who received glucose-free dialysate. Hypertension occurred due to hypotension-induced reflex mechanism through the renin angiotensin aldosterone pathway. Chest pain occurred due to a dialyzer-mediated reaction.

The strength of the study was its prospective nature. The study was carried out in a single centre and the study population might be more homogenous. The study results had to be generalised cautiously. The results of the study were consistent with the findings of many other studies.

CONCLUSION

Hypotension, the most common complication in hemodialysis, has multifactorial origin and it requires constant patient monitoring and early recognition of related signs and symptoms. Routine monitoring of patients during and after the procedure especially those with other comorbidities should be done. There are no accepted guidelines for the management owing to limited research. Patient position, monitoring of the patient's dry weight, and use of certain medications like midodrine hydrochloride are recommended.

Table:1 Baseline Characteristics Of Study Participants (n=160).

Variables		Frequency (n=160)	Percentage (%)
Age group (in years)	30-45	38	23.7
	46-60	54	33.7
	>60	68	42.5
Sex	Male	89	55.6
	Female	71	44.3
Access	AV fistula patients	114	71.2
	Catheter Access Patients	46	28.8
Causes	Hypertension	44	27.5
	Diabetes mellitus	76	47.5
	Chronic Glomerulonephritis	16	10
	Myeloma	5	3.1
	Renal stone	9	5.6
	Bilateral small size kidneys	10	6.3

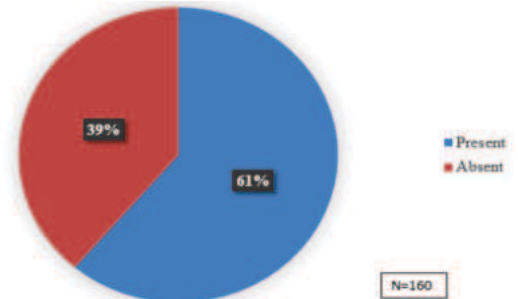


Fig 1: Pie Chart Showing The Proportion Of Participants With Complications.

Table 2: Distribution According To Complications Among The Participants.

Complication	Frequency (n=98)	Percentage %
Hypotension	31	31.6
Muscle cramps	27	27.5
Fever and chills	12	12.2
Headache	10	10.2
Nausea and vomiting	8	8.1
Hypoglycaemia	4	4.1
Hypertension	3	3.1
Chest pain	2	2.1
Catheter tip migration	1	1.1

Table 3: Association Between The Presence Of Complications To That Of Certain Baseline Characteristics.

Variables		Complications				X2	P value
		Present		Absent			
		N=98	%	N=62	%		
Age group (in years)	30-45	24	24.4	14	22.6	3.92	0.140
	46-60	38	38.8	16	25.8		
	>60	36	36.7	32	51.6		
Sex	Male	55	56.1	34	54.8	0.025	0.873
	Female	43	43.9	28	45.2		
Type of access	AV fistula	70	71.4	46	74.2	0.145	0.702
	Catheter Access	28	28.6	16	25.8		

Table 4: Comparison Of Cause And Type Of Complications Among The Study Participants.

Causes	Hypotension		Muscle Cramps		Fever Chills		Headache		Nausea Vomiting		Others	
	N=	%	N=	%	N=	%	N=	%	N=	%	N=	%
Hyper-tension	1	3.2	17	63.0	3	25.0	4	40	1	12.5	0	0
Diabetes mellitus	21	67.7	5	18.5	7	58.3	3	30	5	62.5	8	80
Chronic Glomeru-lone-phritis	5	16.1	0	0.0	0	0.0	1	10	3	37.5	1	10
Myeloma	0	0.0	1	3.7	1	8.3	0	0	0	0.0	0	0
Renal stone	2	6.5	2	7.4	0	0.0	1	10	0	0.0	1	10

Bilateral small size kidneys	2	6.5	2	7.4	1	8.3	1	10	0	0.0	0	0
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