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A study of complications encountered in chronic kidney disease patient undergoing hemodialysis at tertiary health center: A cross sectional study

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Abstract

Background: The prevalence of chronic kidney disease (CKD) is increasing worldwide. The progression of CKD aetiology increases the probability of death, which lowers quality of life (QOL). Therefore, we studied complications encountered in CKD patient undergoing hemodialysis at tertiary health center.

Methods: This is a cross sectional, observational study conducted among 100 patients for 24 months duration. All CKD patients who were undergoing maintenance hemodialysis at tertiary health care center in Vidharba, India. Patients with CKD (stages 3-5) who required hemodialysis, regardless of gender, were included, as were all patients older than 12 years old.

Results: We studied 100 CKD patients undergoing hemodialysis in which 33 (33%) were females and 67 (67%) were males. Hypotension was the most common intradialytic complication (34.2%), followed by muscle cramps (19.5%) and rigors (17.5%). Other complications such as hypoglycemia, nausea, vomiting, chest pain, itching, arrhythmias, and pulmonary edema were reported at lower frequencies. The study found no significant association between age, gender and intradialytic complications. (P value= 0.072).

Conclusion: Based on the outcomes of the study, we can conclude that hypotension is the most frequent intradialytic complications followed by, hypoglycemia, nausea/vomiting, muscle cramp, rigors, chest pain, itching, arrhythmias and pulmonary edema. Majority of patients were found to be comorbid having hypertension, diabetes which again are the factors responsible for worsening of disease.

Keywords: Chronic kidney disease, Hemodialysis, Intradialytic Complications, hypertension, worldwide

Introduction

The burden of CKD is increasing worldwide. ^[1] A three-month or longer period of structural or functional kidney problem is referred to as CKD. ^[2] The kidney dialysis outcomes quality initiative (KDOQI) guideline of the US National Kidney Foundation defines CKD as kidney damage or estimated GFR (eGFR <60 ml/min/1.73m²) for more than 3 months. ^[3] Due to the more number of patients and high cost of care associated with CKD, particularly in developing nations like India it is the global health problem ^[3]. Globally, the predominance of renal disease has risen over the prior twenty years, and it now stands at 11- 13% ^[4].

Globally, the prevalence of CKD is increasing because to the more prevalence of contributory disorders such as diabetes and hypertension. Almost two thirds of CKD cases in western nations are caused by diabetes and hypertension. Diabetes and hypertension are now responsible for 40–60% of CKD cases in India as well. According to the most recent data from the Indian Council of Medical Research, the prevalence of diabetes in the adult population of India has increased to 7.1% (ranging from 5.8% in Jharkhand to 13.5% in Chandigarh), and it is as high as 28% in the urban population (over the age of 40) ^[5]. Prevalence of CKD is anticipated to increase as these diseases become more common in India, making this group the primary target for treatment. The prevalence of CKD has been reported to range from 1% to 13% in various locations, and most recently, data from the Kidney Disease Data Center Study of the International Society of Nephrology indicated a prevalence of 17%. In India, there is a wide range in the aetiology of CKD.

The chronic interstitial nephropathy (CKDu), which has an insidious origin and painfully slow progression, is prevalent in parts of the states of Andhra Pradesh, Odisha, and Goa [6]. Hemodialysis is a technique that eliminates toxic materials (impurities or waste products) from blood when the kidneys are unable to do. Due to growing cases of CKD, patients undergoing dialysis are also increasing approx. by 10-15 percent every year. India is estimated to have about 120,000 patients Hemodialysis and over 8500 patients on peritoneal dialysis. The approximate prevalence of CKD is 800 per million populations; one of the most widely used medical services in the world is hemodialysis. [4]

The burden of CKD and the effect of the disease on quality of life are still not well-documented, despite an increasing frequency of end stage renal disease (ESRD) in India. Yet, offering assistance and care to these people has continued to be a low priority task with little financial resources and specialists and qualified personnel available. To significantly improve patients' quality of life, it is necessary to assess and solve these problems through interdisciplinary and collaborative efforts [7].

This study presents the definition, in depth information, data entry and statistical analysis of CKD patients undergoing hemodialysis. Studying the complications encountered among CKD patients will help us understand the frequency of various hemodialysis complications and will also aid in their management and prevention. The study included all CKD patients who have been hospitalized to a tertiary healthcare facility's Medicine ward for hemodialysis between December 2020 and November 2022. The main motive of this study was to shed light on the patterns and frequency of consequences encountered in CKD patients receiving Hemodialysis at Tertiary Health Center.

Material and Methodology

This is a hospital-based, cross-sectional, observational study was conducted from December 2020 to November 2022 that is over a period of 24 months in the dialysis unit at the Tertiary Health Care Centre in Vidharba, India. 100 patients with CKD who received hemodialysis were included in the study.

Inclusion criteria

1. All the patients with CKD (stages 3–5) who needed hemodialysis both male and female irrespective of gender.
2. Patients over the age of 12 years.

Exclusion criteria

1. Pregnant woman with CKD.
2. CKD patients with Malignancy, TB, HIV, HBSAG, HCV
3. Patients with Acute Kidney Injury.
4. Patients below 12 years of age.

Procedure

This study was conducted in compliance with the protocol, the Institutional Ethical Committee (IEC), and informed consent regulations. Before initiating the study, the investigators were written and dated approval from the IEC for the following documents: study protocol/amendment(s), written informed consent or modification to the study protocol was submitted to the ethics committee (IEC). A clinical finding of the patients was recorded in the case record form. Demographic details was collected and entered

in pre structured case record form. The records were re-examined to note the clinical features. Findings of general examination was entered in case record form, special attention was given to temperature, systolic blood pressure, oxygen saturation, heart rate, respiratory rate, as well as level of consciousness.

- Blood sample was send for the laboratory investigation before and after hemodialysis like Complete Blood Count (CBC), Kidney Function Test (Sr. urea/ Sr. creatinine), and Sr. electrolyte (SODIUM, POTASSIUM).
- Electrocardiogram (ECG) and Chest X-ray (CXR) were done.

Patients were monitored during dialysis by connecting to the monitor with pulse rate, respiratory rate; oxygen saturation, blood pressure, and ECG were recorded in every 10 minutes. ECG leads were placed for cardiac monitoring. Incidences of complications with patients undergoing hemodialysis, most common type of complications were analyzed.

Statistical analysis

Data was recorded in pre structure case record form, from this data was entered in Microsoft Excel and appropriate software and test were applied to find the statistical significant difference. P value <0.05 was considered as statistically significant. A student-paired “t” test was used to compare quantitative data and a chi-square or Fisher’s exact test was used to compare qualitative data. With a P value of 0.05 or lower, the 95% level was set as the confidence level for significance.

Result

Table 1: Demographic data distribution of patients on HD

Gender	Cases	Percentage
Male	67	67%
Female	33	33%
Total	100	100%
Age in years	Cases	Percentage
12-20	8	8
21-30	11	11
31-40	36	36
41-50	27	27
51-60	11	11
>60	7	7

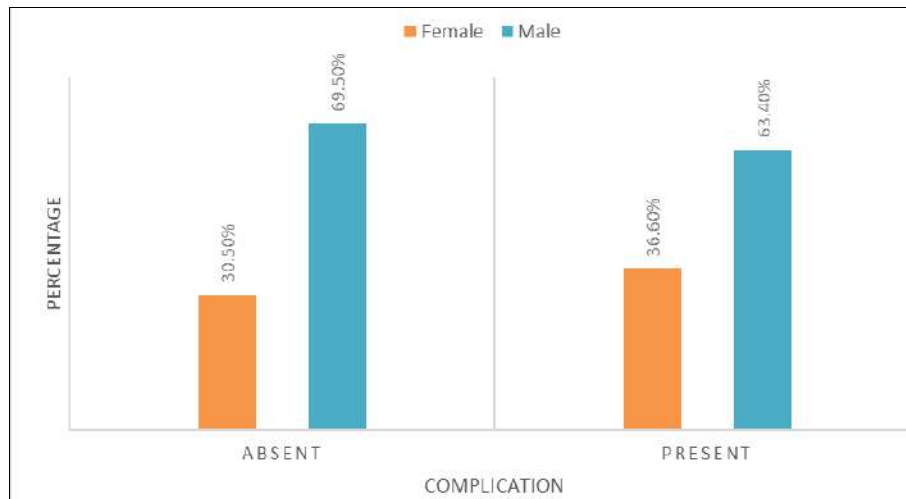
The study included 100 patients in total who met with all inclusion and exclusion requirements. According to Table 1, 33 (33%) of the participants were female, whereas 67 (67%) were male. The majority of the patients (36%) were aged between 31 to 40 years old. A small proportion of the patients (7%) were aged above 60 to 70 years old, while 8% were older than 12 to 20 years old. 11% of the patients were aged between 21 to 30 years old and 51 to 60 years old. A quarter of the patients (27%) were aged between 41 to 50 years old.

Table 2: Frequency of complications during Hemodialysis

Complications	Male	Female	Total	Chi-square, p value
Present	26 (38.81%)	15 (45.45%)	41	0.404, (0.52)
Absent	41 (61.19%)	18 (54.55%)	59	
Total	67 (100%)	33 (100%)	100	

Table 2 shows that among the 67 male patients, 26 (38.81%) had complications and 41 (61.19%) did not. Among the 33 female patients, 15 (45.45%) had complications and 18 (54.55%) did not. Overall, out of the total 100 patients, 41 (41%) had complications and 59 (59%) did not. These

findings suggest that complications were present in a significant proportion of patients in this study, with slightly higher rates observed among females. However, a statistical analysis did not find a significant difference between males and females (p=0.52).



Graph 1: Association of gender with Intradialytic complications

Out of the 33 female patients in the study, 15 (36.60%) experienced complications while 18 (30.50%) did not. Among the 67 male patients, 26 (63.40%) had complications and 41 (69.50%) did not. However, statistical analysis did not show a significant difference between the complication rates of male as well as female patients, with a P value of 0.52.

fell within the age range of 31 to 40 years, followed by 27% aged between 41 and 50 years, 11% between 21 and 30 years and 51 and 60 years, 8% aged between 12 and 20 years, and 7% above 60 years of age. Among patients who experienced intradialytic complications, the highest number (n=16) were in the 31-40 age group. However, the statistical analysis showed that the P value was not significant (P value= 0.072).

Table 3: Intradialytic complications

Complication	Frequency (n=41)	Percent
Hypotension	14	34.2
Hypoglycemia	3	7.6
Nausea/Vomiting	3	7.6
Muscle Cramp	8	19.5
Rigors	7	17.5
Chest pain	3	7.6
Itching	1	2
Arrhythmias	1	2
Pulmonary edema	1	2

In this study, hypotension was the most common intradialytic complication (34.2%), followed by muscle cramps (19.5%) and rigors (17.5%). Other complications such as hypoglycemia, nausea, vomiting, chest pain, itching, arrhythmias, and pulmonary edema were reported at lower frequencies.

Table 4: Association of age with complications

Age group	Complication		Total	P value
	Absent	Present		
12 - 20	6	2	8	0.072 [NS]
21 - 30	8	3	11	
31 - 40	20	16	36	
41 - 50	16	11	27	
51 - 60	6	5	11	
>60	3	4	7	
Total	59	41	100	

The study found no significant association between age and intradialytic complications. The majority of patients (36%)

Discussion

Hemodialysis performed in-center is affordable, but it adds to the financial burden and psychological issues. Bicarbonate solution, online hemodiafiltration as well as continuous renal replacement test procedures are a few examples of recent innovations and modernization in hemodialysis equipment, technology and materials utilized for the session to give the best quality of hemodialysis. [8] Therefore, the primary aim of the present study is to study the complications encountered in CKD patient undergoing hemodialysis at tertiary health center.

In present study, we found that a maximum number of cases between the age of 31 and 40 years make up the majority of the patient population. The majority of patients (n=100) ranged in age from 31 to 40 (36%), but only (7%) of the population were above the age of 60 to 70 years, 8% were between the age of 12 to 20 years. 11% were aged between 21 to 30 years and 51 to 60 years. Between the ages of 41 and 50 years, 27% of cases were present. These outcomes are similar with the study carried out by Thenmozhi & V. Sowmiya *et al.* [9] in 2019 reporting the majority of cases in the age group of 31-40 years. In our study mean age was 38.2 ± 12.36 years and male preponderance in 67% out of 100 cases. Another study conducted by Syed Marghoob Hasan *et al.* [10] with sample size of 704 cases showed Mean age of 46.4 ± 13.8 years with predominantly males (69.8%). Ali M. *et al.* [4] in 2021 also studied a total of 94 patients, with a mean age of 45.51±13.29 years, were present, with 62 (66%) males and 32 (34% females). There is no significant correlation between age and gender distribution

in the present research.

In present study out of 100 cases 41 developed complications during hemodialysis 26 (26%) were male and 15 (15%) were females. Among the intradialytic complications, hypotension was most common complication which occurred in 14 cases (34.2%) followed by muscle cramp 8 cases (19.5%), Rigors 7 cases (17.5%), Hypoglycemia, Nausea & Vomiting, chest pain was developed in 3 cases each (7.6%) and Itching, Arrhythmias, pulmonary edema were seen in 1 case each (2%). Hasan S, *et al.* ^[10] in 2018 studied 740 patients, Total of 466 patients developed patient related complication out of which Hypotension was the most frequent complication developed in 26.8% (N=125) of subjects. Headache (N=117) was the next common complication in his study. The finding in his study is parallel to current study. Jéssica Dantas de Sá Tinôco *et al.* ^[11] Patients generally reported cramps (149; 74.5%), hypotension (141; 70.5%), chills (104; 52%), vomiting (77; 38.5%), headaches (71; 35.5%), dizziness (70; 35%), hypertension (48; 24%), and arrhythmia (40; 20%) as the most common side effects during hemodialysis. In just two patients (1%) of the sample, complications like nausea, convulsions, diarrhoea, and stomach discomfort were common. Among problems, sleepiness, mental anguish, perspiration, weakness, shortness of breath, numbness, bodily aches, and tremors made up 0.5%. Muscle cramps ranked second among the complications in our study.

According to hemodialysis complications statistics, hypotension is the most common complication. The most frequent consequence among HD patients in Prabakar, *et al.* ^[12] studies was hypotension, which affected 20 to 50% of patients. In a different study by Mehimood *et al.* ^[13] 12.5% of patients experienced cramps and 37.5% experienced hypotension.

Hemodialysis (HD) is thought to frequently result in intradialytic hypotension (IDH), which is linked to a greater burden of symptoms, a higher incidence of access failure, cardiovascular events, as well as higher mortality. A meta-analysis of the prevalence of IDH was performed by Kuipers, J. *et al.* ^[14] in 2019. The prevalence of HD sessions complicated by IDH was 10.1 and 11.6% for the European Best Practice Guideline (EBPG) definition and the Nadir 90 definition, respectively, in a meta-analysis that included 4 studies with 1,694 patients and 4 studies with 13,189 patients. The wide range of cutoff values used to identify patients with frequent IDH made it impossible to accurately determine the proportion of patients who had it frequently. The prevalence of symptoms and interventions varied greatly. Diabetes, a higher interdialytic weight gain, female gender as well as lower body weight were main risk factors for IDH across studies. Hypotension was the first most frequent intradialytic consequence to be noted in our investigation. The poor ultra-filtration rate, excessive weight gain, sympathetic over activity as well as clearance of antihypertensive medication during hemodialysis are the most likely causes of intradialytic complications. When comparing the impact of blood pressure variations on mortality and hospitalization rates, a secondary analysis of a randomized controlled trial came to the conclusion that elevated SBP during hemodialysis was related with a greater risk of mortality and hospitalization than hypotension ^[4].

Halle, M. P. *et al.* (2020) ^[15] studied that one of the most common acute complications of hemodialysis (HD) is intradialytic hypotension (IDH), which is linked to higher

patient morbidity and mortality. IDH occurred in 11.6% of HD sessions. In their study, IDH was defined as a drop in systolic blood pressure of more than 20 mm Hg or a drop in mean arterial pressure of more than 10 mm Hg in conjunction with a clinical event. The two main comorbidities that were observed were diabetes and hypertension.

In our study no significant relationship between age, gender distribution, sodium and potassium with intradialytic complications. The study found no significant association between age and intradialytic complications. Thus, our study corroborates other studies observations that Hypotension was the most common complication in CKD patients undergoing hemodialysis. Hemodialysis, a relatively safe operation using contemporary equipment and technology, is a lifeline for those with ESRD. Proper counselling, less intradialytic weight gain, stringent infection control measures, the right dialysate temperature, adjusting antihypertensive medications, and strict monitoring of vital signs during hemodialysis can all help prevent the intradialytic complications listed in the study's findings.

This study does have some limitations. First of all, the study was carried out in a single tertiary institution with a limited sample size, which may have an impact on the generalizability of the results. Second, the study is a cross-sectional observational one that was conducted in a hospital and cannot establish causation or connection. The distribution, aetiology, and clinical symptoms of ESRD in the Indian population must be better understood through multicenter research encompassing a sizable patient population.

Conclusion

In the current study it is clear that, hypotension is the most frequent intradialytic complications followed by, hypoglycemia, nausea/vomiting, muscle cramp, rigors, chest pain, itching, arrhythmias and pulmonary edema. Majority of patients were found to be comorbid having hypertension which again are the factors responsible for worsening of disease. Hence early diagnosis and regular monitoring of blood pressure and blood sugar level helps in preventing the progression of disease. As a result, the progression of kidney damage could be slowed or even prevented with early diagnosis, treatment, and appropriate blood pressure and blood sugar management.

Conflict of Interest

Not available

Financial Support

Not available

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