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Prevalence and Risk Factors of Intradialytic Complications among End-Stage Kidney Disease Patients on Maintenance Hemodialysis in Central Nepal

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ABSTRACT

Background

Intradialytic complications remain a significant barrier to quality care in maintenance hemodialysis (MHD), particularly in resource-limited settings. This study aimed to evaluate the prevalence of intradialytic complications and their association with clinical factors among end-stage kidney disease (ESKD) patients undergoing MHD in a tertiary hospital in Nepal.

Methods

We conducted a hospital-based observational study involving 143 ESKD patients receiving MHD from July 2020 to September 2021. Data on demographics, clinical history, dialysis parameters, and intradialytic events were collected using a structured proforma. Statistical analysis assessed associations between intradialytic complications and factors including diabetes, hypertension, dialysis duration, and food intake during sessions. Ethical approval was obtained from the Institutional Review Committee (Ref. No. 2020-097; Date: November 20, 2020).

Results

Intradialytic complications were observed in 61.5% of patients. The most common was intradialytic hypertension (39.9%), followed by hypotension (14.7%) and headache (14.7%). Chest pain (9.1%), nausea (10.5%), and vomiting (4.9%) were also reported. Intradialytic hypertension was more frequent among patients with diabetes (53.3%) and hypertension (17.6%). It was also more common among patients with dialysis duration <1 year or >5 years, and among those who consumed food during dialysis.

Conclusions

Intradialytic complications were prevalent, with hypertension being the most common. Diabetes, hypertension, dialysis duration, and intradialytic food consumption were significant contributors.

Keywords: end-stage kidney disease; hemodialysis; intradialytic complications; hypotension; hypertension;

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INTRODUCTION

End-stage kidney disease (ESKD) presents a growing global health burden, with a rising number of patients requiring kidney replacement therapy (KRT). Hemodialysis (HD) is the most widely used modality of KRT for ESKD but is frequently complicated by intradialytic events that can affect patient outcomes, reduce treatment adequacy, and compromise quality of life.[1, 2] The risk of intradialytic complications is heightened by the rapid removal of solutes and fluid during relatively short HD sessions, which can precipitate hemodynamic instability, arrhythmias, and neurologic symptoms due to disequilibrium.[3, 4] These events are particularly prevalent in elderly patients and those with comorbidities such as diabetes and heart failure.[3] In resource-limited countries like Nepal, intradialytic complications are of special concern due to shortages of trained staff, limited infrastructure, and restricted access to advanced technologies. Hypotension is the most common complication, reported in 4-17% of HD sessions, and is associated with increased mortality and cardiovascular events. Aggressive ultrafiltration, often necessitated by inadequate fluid management tools, further heightens this risk.[4] Other common adverse events include intradialytic hypertension, cramps, headache, and fatigue, which may be under-recognized in low-resource settings. Hemorrhagic events such as access rupture or needle dislodgement and infectious complications, particularly catheter-related bloodstream infections, add to the clinical burden in environments where infection control and access monitoring are less robust.[3,4] Despite these risks, there is limited literature from Nepal examining the frequency and predictors of intradialytic complications. This study therefore sought to evaluate their prevalence and patterns among ESKD patients on maintenance HD in central Nepal, and to explore associated clinical and behavioral factors.

METHODS

An analytical cross-sectional study was conducted from July 2020 to September 2021 at the Dialysis Unit of medical college in central Nepal. Hemodialysis was performed using a Fresenius Hemoflow Dialyser (F6HPS) with a dialysate flow rate of 500 mL/min and a blood flow rate of 250–300 mL/min. The dialysate temperature was maintained at 37°C. Vascular access was established via arteriovenous fistula, jugular permanent or temporary catheter, or femoral catheter, depending on availability. Patients were prescribed 4-hour HD sessions twice weekly. Standard heparinization with 5000 units was routinely administered, except in patients at high risk of bleeding. Ultrafiltration was adjusted according to each patient's target dry weight. Patients aged ≥18 years with a diagnosis of ESKD undergoing maintenance HD were included. Exclusion criteria were: acute kidney injury, emergency dialysis, age<18 years, positive viral serology (HIV, HBsAg, or anti-HCV), or refusal to participate. A total of 143 patients were enrolled using total enumeration sampling. Ethical approval was obtained from the Institutional Review Committee (IRC Ref. No. 2020-097, Date: 2020-11-20), and written informed consent was obtained from all participants. Information was collected using a structured pro forma through patient interviews and direct observation during HD sessions. Independent variables included demographics, duration and frequency of dialysis, vascular access type, and comorbidities. Dependent variables were intradialytic complications such as nausea, vomiting, muscle cramps, chills, fever, headache, chest pain, hypotension, hypertension, itching, and hypoglycemia. These were identified through intradialytic monitoring of blood pressure, blood glucose levels, and patient-reported symptoms. Intradialytic hypotension was defined as a fall of ≥ 20 mm of Hg in systolic blood pressure from the baseline or a decrease in mean arterial BP>10 mm of Hg.[5] Intradialytic hypertension is defined as an increase in systolic BP (SBP) >10 mm of Hg from baseline pre to post dialysis.[6] Intradialytic hypoglycemia was defined as blood glucose level less than <100 mg/dl in patients during the HD session in previously maintained blood glucose level.[7]

Data were entered into Microsoft Excel 2016 and analyzed using SPSS version 16. Categorical

variables were summarized as frequencies and percentages, and continuous variables as mean±SD. Associations between risk factors and intradialytic complications were assessed using chi-square tests, with p-value<0.05 considered statistically significant.

RESULTS

A total of 143 patients were included in the study. The mean age was 46.3±14.3 years, with a predominance of males (62.2%). Most patients were aged 25–50 years (53.8%), followed by >50 years (39.2%), and <25 years (7%), (Table 1).

Table 1. Demographic characteristics of patients undergoing hemodialysis.

Characteristic	Frequency (%)
Age (mean ± SD)	46.3±14.3
Age range (years)	16-84
Male	89 (62.2)
Female	54 (37.8)

Diabetes mellitus was present in 30.8% of patients, while 35.7% had a history of hypertension. The duration of maintenance HD was <1 year in 39.9% of patients, 1–5 years in 48.3%, and >5 years in 11.9%. The mean dialysis duration was 2.0±1.62 years (range: 6 months–8 years), (Figure 1).

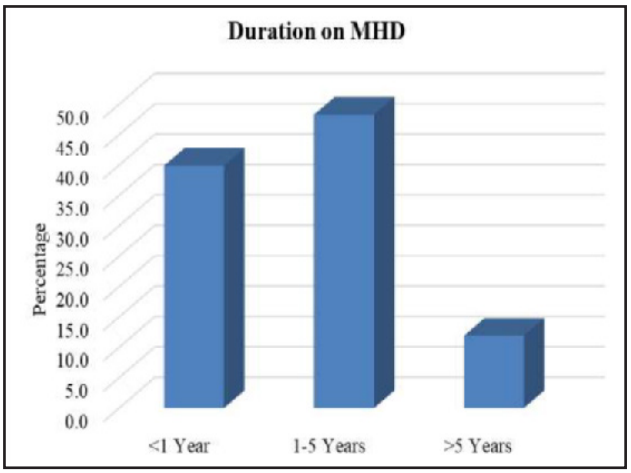

Figure 1. Figure showing the patients on total duration on Maintenance hemodialysis and development of intradialytic complication which is highest among duration between 1 and 5 years and least in above 5 years.

95.1% of patients reported consuming food during the HD session. Overall, 61.5% of patients experienced at least one intradialytic complication. The most frequent was intradialytic hypertension (39.9%), followed by hypotension (14.7%) and headache (14.7%). Other reported complications included nausea (10.5%), chest pain (9.1%), muscle cramps (5.6%), vomiting (4.9%), itching (3.5%), chills (2.1%), and fever (0.7%), (Figure 2).

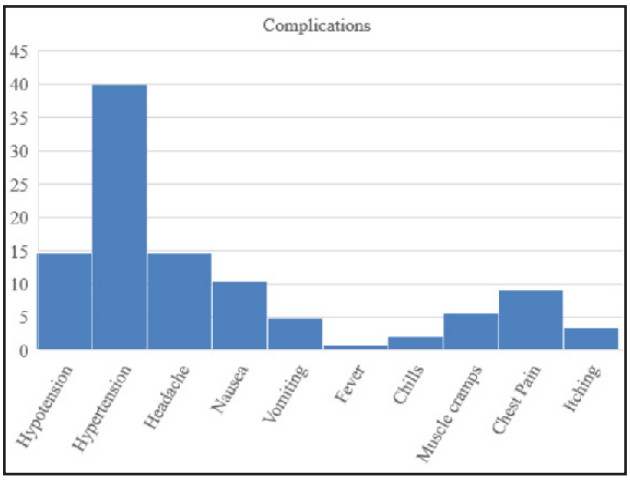

Figure 2. Intradialytic complications observed among the patients. Intradialytic hypertension was the commonest followed by headache, hypotension, nausea and chest pain and least being fever.

Although some patients exhibited symptoms suggestive of hypoglycemia, these were treated symptomatically, and due to the inability to consistently test glucose levels, hypoglycemia was not formally included in the analysis. Regarding vascular access, the vast majority of patients (94.4%) were dialyzed through an arteriovenous fistula (AVF), with only a small proportion using jugular catheters, permanent catheters, or femoral catheters (Table 2).

Table 2. Types of vascular access available for hemodialysis, AV fistula was common vascular access followed by IJ catheter.

Access Type	Frequency (%)
AV fistula	135(94.41)
IJ catheter	5(3.50)
Perma Cath	2(1.40)
Femoral perma cath	1(0.70)

Note: AV fistula: Arterial venous fistula, IJ catheter: Internal Jugular catheter, Perma cath: tunneled catheter.

Among patients with diabetes (n=44), 11.4% (n=5) developed intradialytic hypotension; however, this association was not statistically significant (p-value >0.05). In contrast, intradialytic hypertension was observed in 52.3% (n=23) of diabetic patients, showing a statistically significant association with diabetes (p-value<0.05). Similarly, a history of hypertension was not significantly associated with intradialytic hypotension (p-value>0.05), but was significantly associated with intradialytic hypertension (p-value<0.05). No statistically significant associations were found between dialysis duration or food intake during HD and the occurrence of intradialytic hypotension or hypertension (p-value>0.05) (Table 3).

Table 3. Association of risk factors like diabetes, hypertension, food consumption, and hemodialysis vintage and development of intradialytic complications.

Conditions	Intradialytic Hypertension n(%)	Intradialytic Hypotension n(%)
Diabetes (n=44)	23(53.3%)	5(11.4%)
Hypertension (n=51)	9(17.6%)	5(9.8%)
Food intake during HD (n=135)	52(38.2%)	19(14.0%)
MHD duration <1	27(47.4%)	8(14%)
MHD duration 1-5 years (n=69)	21(30.4%)	11(15.9%)
MHD duration >5 years	9(52.9%)	2(11.8%)

Note: HD: Hemodialysis, MHD: Maintenance hemodialysis.

Intradialytic hypertension was commonly observed in patient with diabetes, hypertension, intradialytic food consumption and dialysis vintage of <1 year and above 5 years.

DISCUSSION

The global burden of ESKD continues to rise, with the demand for KRT projected to more than double by 2030, particularly in Asia. HD remains the most common modality, accounting for nearly 70% of KRT worldwide.[8] Although government-supported programs in Nepal now provide free lifetime HD and financial support for transplant recipients, many patients continue to face logistical barriers that limit access and adherence to treatment. In our study, nearly all patients (97.9%) were receiving twice-weekly HD, a pattern similar to other low- and middle-income countries.[9-11] The mean age of patients in our cohort was 46.3 years, lower than that reported in Western populations but consistent with findings from Nepal and other developing countries.[12,13] Hypertension (35.7%) and diabetes mellitus (30.8%) were the leading comorbidities, in line with prior Nepalese studies. The etiology of ESKD was often uncertain, reflecting late presentation and limited diagnostic capacity.[14-16] Intradialytic complications occurred in 61.5% of patients, a frequency higher than some internsational reports but consistent with previous studies from Nepal. The most common complication was intradialytic hypertension (39.9%), with prevalence rates comparable to those reported globally (5–57%).[17-19] This complication is multifactorial, linked to subclinical volume overload, vascular stiffness, and inadequate dialysis adequacy.[20] In our study, both diabetes and preexisting hypertension were significantly associated with intradialytic hypertension, emphasizing the need for closer monitoring in these high-risk groups. Intradialytic hypertension is linked to increased hospitalization and mortality, though causality is uncertain. Intradialytic hypotension and headache (each 14.7%) were the next most common complications. Hypotension is well recognized as the most frequent dialysis-related adverse event, caused by rapid ultrafiltration and impaired compensatory mechanisms.[21,22] Although not significantly associated with diabetes, hypertension, dialysis duration, or food intake in our cohort, its clinical importance remains high given its association with cardiovascular instability and mortality.[22-24] Headache during HD, a multifactorial condition, was also reported at a

moderate prevalence. The symptoms likely reflect rapid osmotic and hemodynamic changes, and although typically self-limited, they affect quality of life.[31] Recognition and mitigation of modifiable risk factors is central to management. Intradialytic headache can be moderate to severe, bilateral, and often frontal or frontotemporal headache that develops during the dialysis session most commonly within 1–3 hours after initiation and resolves within hours to a few days post-dialysis. [25, 26] Associated symptoms may include nausea and vomiting, but focal neurological deficits are generally absent.[27]

Nutritional practices during HD were notable: 95% of patients consumed food during sessions. While prior studies have linked intradialytic feeding with postprandial hypotension and reduced dialysis adequacy, our study did not identify significant associations with intradialytic complications.[28 31]

The absence of caloric quantification and variability in patient intake may explain this discrepancy. Interestingly, intradialytic hypertension was reported in 38.2% of patients who ate during HD an observation that warrants further exploration, as current evidence does not strongly support a causal link.[29, 30] Dialysis duration showed no significant association with hypotension, but intradialytic hypertension appeared more common in patients with <1 year or >5 years on HD. This pattern may reflect inadequate cardiovascular adaptation in early treatment and progressive vascular stiffening over time.

Limitations

This study has several limitations. As a single-center, cross-sectional design, the findings cannot establish causality and may not be generalizable to other settings. Important clinical parameters such as Kt/V, ultrafiltration rates, and detailed nutritional assessments were not collected, which limits the evaluation of dialysis adequacy. Hypoglycemia may have been underestimated due to incomplete glucose monitoring. The reliance on patient self-report for certain symptoms introduces potential recall bias, and the lack of standardized diagnostic criteria for some complications may reduce comparability with other studies. Additionally, unmeasured confounders including medication use, interdialytic weight gain, and adherence to dialysis schedules may have influenced the results.

CONCLUSIONS

Intradialytic complications are common among ESKD patients undergoing maintenance hemodialysis in Nepal, with intradialytic hypertension as the most frequent event, followed by hypotension and headache. The strong association of intradialytic hypertension with diabetes and preexisting hypertension highlights the importance of vigilant monitoring and individualized blood pressure management in these high-risk groups. Although most patients received twice-weekly hemodialysis, logistical barriers and limited resources may contribute to underdialysis, potentially increasing the risk of complications. Eating during dialysis was not significantly linked to hypotension in this cohort, but its potential role in blood pressure variability warrants further study. Similarly, dialysis vintage showed no significant association with hypotension, suggesting that patient-specific and prescription-related factors may be more influential than treatment duration alone. To reduce the burden of intradialytic complications, targeted strategies are needed, including optimization of ultrafiltration rates, individualized antihypertensive regimens, improved dialysis adequacy, and strengthened vascular access care. Expanding patient education and resource allocation in dialysis units could further enhance safety and quality of life. Future prospective studies incorporating dialysis adequacy metrics and detailed nutritional assessments are essential to guide evidence-based practice in the Nepalese context.

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