FREQUENCY AND RISK FACTORS FOR INTRADIALYTIC HYPOTENSION IN PATIENTS UNDERGOING MAINTENANCE HEMODIALYSIS

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ABSTRACT

Hemodialysis (HD) patients and providers have long struggled with intra-dialytic hypotension (IDH), a complication that continues to challenge the safety and effectiveness of HD. IDH is associated with chronic end-organ damage and remains an independent risk factor for mortality among HD patients. Persistent hemodynamic instability may also accelerate the decline of residual renal function, further worsening clinical outcomes. Because individuals on dialysis already face markedly increased cardiovascular mortality and morbidity, identifying the prevalence and contributing factors of IDH has become an important clinical and academic priority. This observational study was carried out in the Hemodialysis Unit of Nepal Medical College and Teaching Hospital over one year (Baishakh 2079 to Chaitra 2079 B.S, April 2022 to March 2023 AD) without interventions or the collection of patient material. Ethical approval was obtained from the Institutional Review Committee. During each dialysis session, patients were assessed for pre- and post-dialysis weight, blood pressure, and heart rate at multiple intervals, ultrafiltration volume, and any clinical events or medical interventions related to intra-dialytic hypotension. A total of 110 patients participated, contributing 5,232 dialysis sessions. The incidence of IDH varied widely depending on the definition used, measuring 14.47% and 9.42% under stricter criteria, and rising to 62.8% with a more liberal definition. Although HD remains a widely used and generally safe modality, complications such as IDH persist and can be life-threatening. As complications and their associated factors continue to change over time, a more vigilant and systematic approach is needed to identify, monitor, and address them effectively. This highlights the need for ongoing evaluation in HD practice.

KEYWORDS

Chronic kidney disease, hemodialysis, intra-dialytic hypotension

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INTRODUCTION

During hemodialysis (HD), diffusion of solutes between the blood and a dialysis solution results in the removal of metabolic waste products and the replenishment of body buffers.[1] Hypotension is the most common adverse event during dialysis. Although other factors may contribute, ultrafiltration (UF)- induced volume depletion is the most important cause.

Intradialytic hypotension (IDH) is a widely recognized treatment-related complication that has plagued patients and providers since the beginning of hemodialysis. It has three essential components: a drop in blood pressure (BP) generally defined as ≥20 mmHg systolic BP or ≥10 mmHg in mean arterial pressure (MAP); the presence of symptoms of end-organ ischemia; and intervention carried out by the dialysis staff.[2]

IDH results in chronic end-organ damage and is an independent risk factor for mortality in HD patients.[3] Hemodynamic stability has also been implicated in accelerating the decline in residual renal function. The resulting ischemia leads to serious vascular complications such as recurrent brain injury from transient ischemic attacks and gastrointestinal angina. Another extremely vulnerable vascular bed is the coronary microcirculation.

Given the higher risk of cardiovascular morbidity and mortality among adults undergoing dialysis, this topic has attracted considerable academic attention and debate. Furthermore, this study aims to identify the CKD population and assess the prevalence and associated risk factors of IDH.

MATERIALS & METHODS

This observational study was conducted in the HD unit of Nepal Medical College and Teaching Hospital (NMCTH), over a period of one year (Baishakh 2079 to Chaitra 2079 BS, April 2022 to March 2023 AD), without intervention or obtaining any patient material. Patients presenting to the dialysis unit of the Nephrology Department of NMCTH and fulfilling the inclusion criteria were selected. At each session, patients were evaluated for pre-and post-dialysis weight and pre-, intra-, and post-dialysis blood pressures and heart rate, UF volume, and the occurrence of clinical events possibly related to dialysis hypotension and medical interventions.

Several different definitions of hypotension have been used in the literature, complicating the analysis of IDH. These vary from liberal definitions that only require a minimum fall (e.g. ≥20 or ≥30 mmHg) in systolic blood pressure (SBP)[1,5] to strict definitions that require the combination of a clinical event and a nursing intervention in addition to a minimum fall in blood pressure.[5,6]

Clinical events; defined as nausea, dizziness, light-headedness, fatigue occurring during hemodialysis, muscle cramps, loss of consciousness, or any other additional complaint that would be related to the dialysis procedure as judged by the patient and/or medical personnel (miscellaneous clinical events) were noted.

Medical intervention was defined as a temporary interruption of UF, Trendelenburg position, and administration of intravenous fluids.

Blood pressure and heart rate was measured at standardized intervals: before hemodialysis, at 10 min and 30 min interval during the dialysis, and at the end of the dialysis session. Prescriptions regarding dry weight and antihypertensive medication was made by the nephrologists during their weekly visit to the participating patients.

Data was entered and analyzed using SPSS-20. Descriptive statistics (mean±SD, frequency, percentage) summarized demographic and clinical variables. The prevalence of IDH was calculated. Chi-square test and Independent t-test were used to assess associations. A p-value <0.05 was considered statistically significant.

RESULTS

In this study, a total of 117 patients were enrolled, a total of 5,232 dialysis sessions were included, the mean age was 48.44 ±14.75 years, with 70.1% of the age group below 60 years of age, with 33.3% within the age group of 18-39 years, which is the most productive phase of life. Among total cases, 7 cases were excluded from study due to mortality due to other cause besides IDH.

In this study, the incidence of IDH as per the KDOQI definition was 14.47%, and 9.42% as per the EBPG definition of IDH. However, a more liberal definition of decrease in SPB >20 mmHg or MAP of >10 mmHg increased the incidence to up to 62.8% in our study. Headache (8.12%) was the most frequent symptom experienced by the patients, followed by dizziness and abdominal discomfort. There was an increased risk of IDH with increasing UF volume and when

Table 1: Clinical practice guideline definitions for intradialytic hypotension

Guideline (Year)	Intradialytic hypotension definition
K/DOQI Clinical Practice Guidelines (2002)[5]	A decrease in systolic BP ≥20 mm Hg or a decrease in MAP ≥10 mm Hg associated with symptoms that include: abdominal discomfort; yawning; sighing; nausea; vomiting; muscle cramps; restlessness; dizziness or fainting; and anxiety.
European Best Practice Guidelines (2007)[6]	A decrease in systolic BP ≥20 mm Hg or a decrease in MAP ≥10 mm Hg associated with clinical events and need for nursing interventions
UK Renal Association Guidelines (2009)[19]	An acute symptomatic fall in BP during dialysis requiring immediate intervention to prevent syncope.
Japanese Society for Dialysis Therapy Guidelines (2012)[20]	Symptomatic sudden drop systolic BP ≥30 mm Hg during dialysis or a decrease in the mean BP by ≥10 mm Hg

BP, blood pressure; K/DOQI, Kidney Disease Outcomes Quality Initiative; MAP, mean arterial pressure

Table 2: Incidence of IDH as per UF volume

	Overall Hypotension			
UF volume (l)	**No**		**Yes**	
< 1.5	612	31.61%	330	10.01%
1.6 to 2.5	510	26.34%	642	19.48%
2.6 to 3.5	388	20.04%	1098	33.31%
3.6 to 4.5	410	21.18%	972	29.49%
> 4.5	16	0.83%	254	7.71%
Total	**1936**	**37.2%**	**3296**	**62. 8%**

Table 3: Incidence of IDH as per intake of meal during HD

	Overall hypotension (n= 5232)			
Meal intake	**No**		**Yes**	
No	1292	66.74%	818	24.82%
Yes	644	33.26%	2478	75.18%
Total	**1936**	**37.2%**	**3296**	**62.8%**

patients had meals during HD, i.e., 70.51% of hypotensive patients, when ultrafiltrate was more than 2.6 L. Similarly, 94.07% had IDH when UF volume was more than 4.5 L. 75.18% of hypotensive patients had a meal of some kind during the HD sessions.

Medical intervention was required in 14.95% of the hypotensive patients and repositioning the

Table 4: Various intervention during IDH

Intervention	n	%
Trendelenburg position	201	6.10
Decrease ultrafiltrate rate	173	5.25
Dialysis cessation	41	1.24
Fluid administration <250ml	72	2.18
Fluid administration 500ml	6	0.18
None	2,803	85.04
Total	**3,296**	

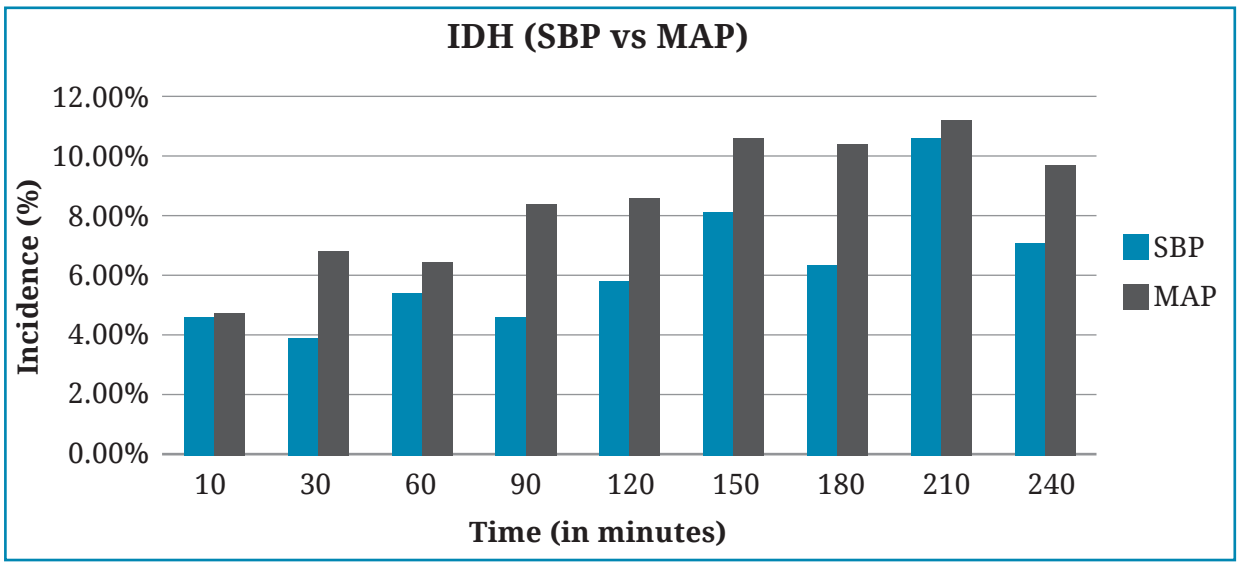

Fig 1: Bar diagram showing prevalence of hypotension based on SBP and MAP

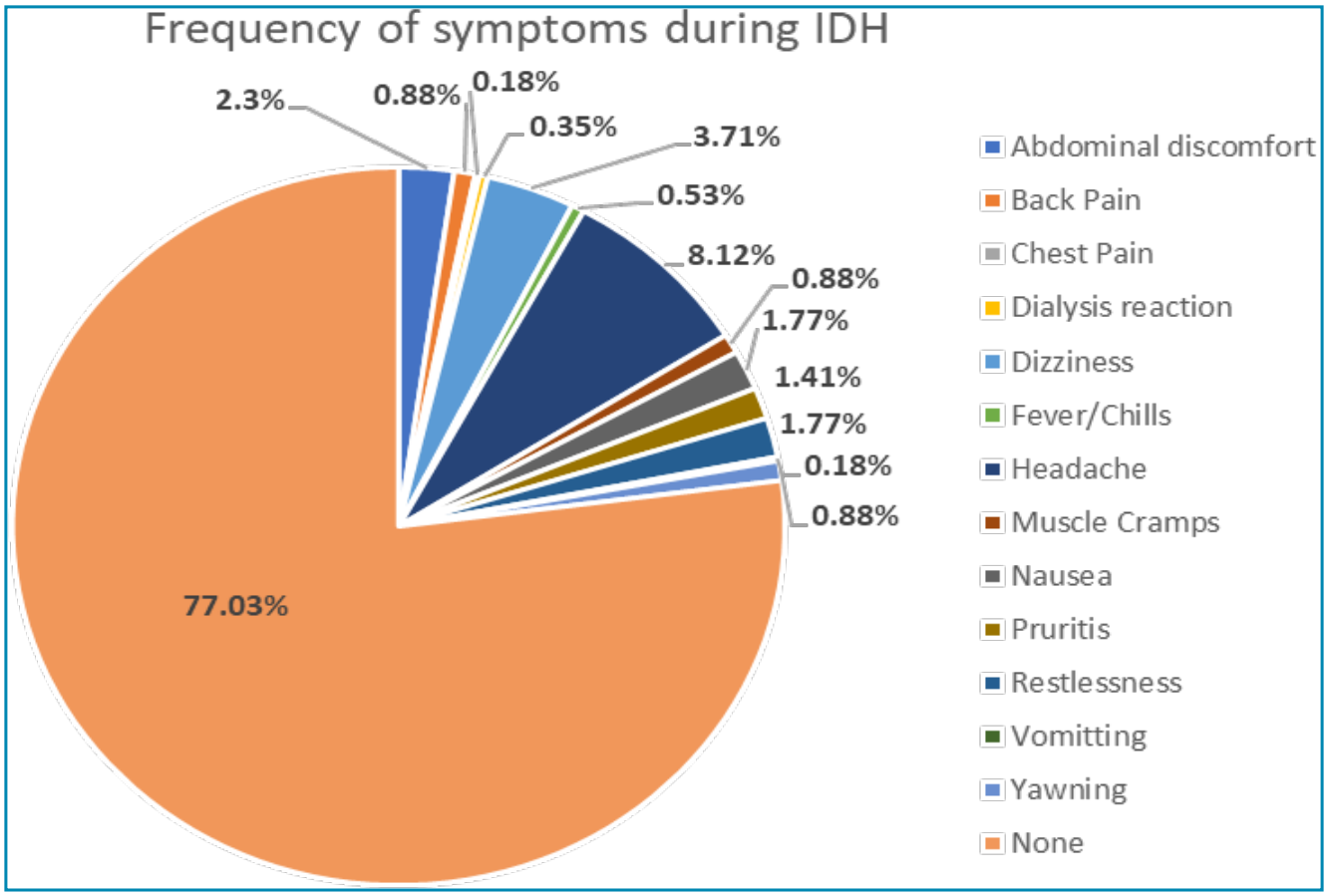

Fig. 2: Pie chart showing various symptomatology during IDH

patient to Trendelenburg was most frequent, 6.10%, and dialysis had to be stopped in 1.24% of sessions due to IDH.

DISCUSSION

In this study, the age group in our study is similar to studies by Hada *et al*,[7] Mishra *et al*,[8] and Chhetri *et al*.[9] The most productive phase of life was spent on HD in the majority of patients. Moreover, the study population was older than reports from developing countries like Bangladesh, India, and Pakistan, but younger compared to developed countries, where most patients are above 60 years.[10-12]

The main aim of the study was to observe the incidence of intradialytic hypotension (IDH). Using different definitions, the incidence varied widely.[13-15] IDH is linked with cardiovascular mortality, all-cause mortality, and conditions like cardiac stunning.[15,16] Studies show that drops in systolic BP during dialysis increase risk of poor outcomes.[3]

Symptoms during IDH included headache (8%), dizziness (3.71%), abdominal discomfort (2.3%), and nausea or restlessness (1.77%), which were similar to other studies.[7,9]

IDH episodes were strongly associated with higher UF volume. High UF rates reduce blood volume and cardiac output, and UF rates above 13 mL/kg/hr increase the risk of both IDH and mortality.[17]

Meal intake during dialysis also contributed to IDH. Oral intake causes splanchnic vasodilation, reduces cardiac output, and lowers systemic vascular resistance, making patients more prone to hypotension, especially because HD patients often have autonomic dysfunction.[18]

In conclusion, the prevalence of dialysis hypotension according to the European Best Practice Guidelines definition is low. The dominant determinant of the European Best Practice Guidelines definition was medical intervention since this was the component with the lowest prevalence, so was true in this study.

Based on the above findings following recommendation are given.

- Blood pressure monitoring during HD is crucial however MAP calculation should not be overlooked.
- Patients should be emphasized regarding fluid intake and maintaining optimal IDWG, as these lead to adverse long term CV morbidity.

- Medical personnel in HD unit should be vigilant regarding patients symptoms as many go unnoticed or are undermined.
- Patient who has meals during HD sessions should be carefully monitored as they have higher risk of IDH.

Limitations: This study has several limitations. It was conducted in a single hospital and used an observational design, allowing only associations. The IDH definition is varied, and dry weight was not measured objectively, which may have affected blood pressure results. Blood pressure readings may also be biased by vascular disease. Interpretation of symptoms and decisions to intervene can vary between physicians. Important risk factors such as myocardial infarction, tamponade, hemolysis, hemorrhage, autonomic neuropathy, anemia, and medications were not assessed due to financial limitations. Finally, the link between IDH and outcomes like mortality and hospitalization was limited by short follow-up and few events.

Conflict of interest: None

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