

Frequency of Intradialytic Hypertension in End Stage Renal Disease Patients on Maintenance Hemodialysis

Intradialytic Hypertension in End Stage Renal Disease

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ABSTRACT

Objective: The primary aim of this investigation is to assess the incidence rate of IDH (Intradialytic hypertension) among patients undergoing dialysis. Additionally, the study aims to identify and analyze different factors that contribute to the enhancement of evidence-based management strategies and clinical outcomes in this context.

Study Design: Cross sectional study

Place and Duration of Study: This study was conducted at the Khyber Teaching Hospital, Nephrology Department in Peshawar, Pakistan from 18th June 2020 to 18th December 2020.

Materials and Methods: After obtaining informed consent, data were prospectively collected from a total of 187 patients who met the predefined diagnostic criteria. Simple descriptive statistics, including mean and standard deviation were used to analyze quantitative data, while for qualitative characteristics, frequency and percentages were used. Chi-square post-stratification analysis was employed and a significance level of $p < 0.05$ was used.

Results: A total of 187 eligible patients (54% male, 46% female) participated in the study. The mean age of subjects was 39.4 ± 16.5 years, and mean body mass index (BMI) was 22.3 ± 4.9 kg/m². The duration of hemodialysis varied between 0 and 30 months, with a mean duration of 10.17 ± 6.05 months. Among the participants, 10.1% (n=19) were found to have intra-dialytic hypertension. Of those with intra-dialytic hypertension, 47.3% (n=9) were receiving erythropoiesis-stimulating agent (ESA) treatment. Stratification analysis was carried out to explore the association between intra-dialytic hypertension and various factors.

Conclusion: Intra-dialytic hypertension occurrence is recorded in a substantial group of our local population with end stage renal disease (ESRD). There are few studies on its pathophysiology, risk factors and outcome after treatment in ESRD patients. We suggest further studies to detect the occurrence of intra-dialytic hypertension and its potential outcome as in long term it increases the morbidity and mortality.

Key Words: End stage renal disease, hemodialysis, intra-dialytic hypertension

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INTRODUCTION

The prevalence of chronic kidney disease (CKD) patients requiring dialysis exhibits variability. It has been estimated that approximately 2.5 million individuals needed dialysis in 2010¹. Hemodialysis, a crucial treatment option for patients with end-stage renal disease (ESRD), is not without its complications and challenges.

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Intra-dialytic hypertension represents a cardiovascular complication of hemodialysis that poses significant risk of morbidity and mortality². Present evidence indicates that IDH impact approximately 15% of individuals undergoing hemodialysis³. Patients who exhibit an unexpected increase in mean arterial blood pressure (MAP) of at least 15 mm Hg during or immediately after hemodialysis (or) an increase in systolic blood pressure (SBP) exceeding 10 mm Hg from pre-dialysis to post-dialysis^{4,5}. The prevalence of intra-dialytic hypertension (IDH) in hemodialysis patients varies from 13% to 33% depending on the specific diagnostic criteria employed⁶. Notably every 10 mmHg increase in blood pressure during hemodialysis corresponds to a 6% increase in mortality risk over a span of two years⁴. Chronic volume overload is a frequently observed condition in hemodialysis patients and is considered a contributing factor to IDH³. Dialysis-related factors can exacerbate endothelial dysfunction, further contributing to IDH⁷. Electrolyte imbalances⁸ and the utilization of erythropoiesis stimulating agents (ESA) may amplify the risk of IDH in certain patients,

particularly those with pre-existing high blood pressure or volume overload⁹. Interestingly, pre-dialysis intake of beta-blockers has been linked to a diminished risk of IDH, even after adjusting for confounding factors. On the other hand, the clearing out of antihypertensive medications, specifically ACE inhibitors and certain beta-blockers, during dialysis has been found to potentially result in elevated blood pressure levels during the dialysis sessions¹⁰.

The objective of this study is to ascertain the prevalence of intra-dialytic hypertension in end-stage renal disease (ESRD) patients on maintenance hemodialysis. Limited clinical data exists on this condition and its risk factors, emphasizing the need for localized investigations. Analyzing these risk factors in ESRD patients receiving maintenance hemodialysis will aid in formulating evidence-based management strategies and treatment guidelines. The study's outcomes will optimize patient care and enhance clinical outcomes for this specific population.

MATERIALS AND METHODS

In this six-month cross-sectional study at Khyber Teaching Hospital, Peshawar, Pakistan, from June to December 2020, 187 participants on biweekly hemodialysis (aged 18-75 years) were included after ethical approval. Patients unable to measure blood pressure in upper limbs, non-consenting individuals, those with acute or acute on chronic renal failure requiring hemodialysis, those receiving blood/ fluid transfusions or inotropic support during dialysis, and hyperthyroidism patients were excluded from the study. Informed consent was obtained, and relevant biodata and factors influencing intra-dialytic hypertension were recorded on a pre-designed proforma. Blood pressure measurements were taken every 30 minutes during

dialysis session through an automatic cuff machine. Intra-dialytic hypertension was defined as a ≥ 10 mmHg increase in systolic blood pressure compared to pre-dialysis baseline. IBM-SPSS Version 23 was used for data analysis. Quantitative variables were summarized with means \pm SD, and categorical data (intra-dialytic hypertension, gender, antihypertensive usage, erythropoiesis stimulating agent usage) were presented as frequencies and percentages. Stratification analysis based on various factors was performed using post-stratification chi-squared test ($p \leq 0.05$).

RESULTS

The study consisted of a total of 187 eligible patients. Among them, 54% (n=101) were male, while 46% (n=86) were female. The average age of the patients was 39.4 ± 16.5 years, and the mean body mass index (BMI) was calculated to be 22.3 ± 4.9 kg/m². The duration of hemodialysis ranged from 0 to 30 months, with a mean of 10.17 ± 6.05 months. The mean hemoglobin level was 8.9 ± 1.35 g/dl. Intra-dialytic hypertension, defined operationally, was observed in 10.1% of the patients (n=19). Among these cases, 47.3% (n=9) of the patients were receiving erythropoiesis-stimulating agent (ESA) treatment. To assess the association between intra-dialytic hypertension and various factors, including age group, gender, BMI, duration of hemodialysis, ultrafiltration volume per session, antihypertensive medication usage, ESA administration, hemoglobin levels, serum sodium and calcium concentrations, dialysate sodium and calcium concentrations, and dialysate temperature, stratification analysis was performed. The results of these stratifications, along with their respective significance values (P-values), are presented in Table 1.

Table No. 1: Clinical and demographic attributes of dialysis patients with and without intradialytic hypertension.

Parameter	Intradialytic hypertension (N=19)	No Intradialytic hypertension (N=168)	P value
Age group years n (%)			0.5700
18-40 years	13 (11.1%)	104 (88.9%)	
40 – 75 years	6 (8.5%)	64 (91.5%)	
Gender n (%)			0.1130
Male	7 (6.9%)	94 (93.1%)	
Female	12 (13.9%)	74 (86.1%)	
BMI group n (%)			0.2700
<25 kg/m ²	11 (8.5%)	118 (91.5%)	
>25 kg/m ²	8 (13.7%)	50 (86.3%)	
Duration of hemodialysis group n (%)			0.6070
< 12 months			
> 12 months	10 (11.3%)	78 (88.7%)	
	9 (9%)	90 (91%)	
Ultrafiltration volume per session group n (%)			0.0240
< 1 liter	5 (5.2%)	90 (94.8%)	

> 1 liter	14 (15.2%)	78 (85.8%)	
Antihypertensive medication usage prior to hemodialysis group n (%)			0.0001
Yes	3 (2.4%)	118 (97.6%)	
No	16 (24.2%)	50 (75.8%)	
Erythropoiesis stimulating agent used group n (%)			0.0009
Yes	9 (5.9%)	142 (94.1%)	
No	10 (27.7%)	26 (72.3%)	
Hemoglobin group n (%)			0.0073
< 10 g/dL	7 (5.9%)	110 (94.1%)	
> 10 g/dL	12 (18.7%)	52 (81.3%)	
Serum Sodium group n (%)			0.0048
< 135 mEq/L	2 (2.6%)	74 (97.4%)	
> 135 mEq/L	17 (15.3%)	94 (84.7%)	
Serum Calcium group n (%)			0.0062
< 9 mg/dL	4 (4.2%)	91 (95.8%)	
> 9 mg/dL	15 (16.3%)	77 (84.7%)	
Dialysate Sodium group n (%)			0.6835
< 130 mEq/L	6 (8.9%)	61 (90.1%)	
> 130 mEq/L	13 (10.8%)	107 (89.2%)	
Dialysate Calcium group n (%)			0.0110
< 1.25 mg/dL	4 (4.3%)	87 (95.7%)	
> 1.25 mg/dL	15 (15.6%)	81 (84.4%)	
Dialysate temperature group n (%)			0.0699
< 36.5 (C)	9 (16.3%)	78 (83.7%)	
> 36.5 (C)	10 (7.5%)	90 (92.5%)	

N.B **Bold** values are considered significant.

DISCUSSION

Among the 187 patients included in this study, 19 individuals (10.1%) had intradialytic hypertension (IDH). This observed frequency is consistent with a previous study conducted in the United States in 2018, which reported rates ranging from 5% to 20% for hemodialysis treatments¹¹. However, the IDH frequency observed in our study is notably lower compared to rates reported in other countries, such as Senegal (22.6%) Italy (23.1%)¹³, South Africa (28.4%)(14), Nigeria (45.3%) and Cameroon (48.3%).⁶ In this study 39.4 ± 16.5 years was the mean age of the patients. This finding aligns with similar studies conducted by other authors, who reported a range of 38.0 ± 5.9 years¹³. However, it differs from studies conducted in other regions, such as one reporting a mean age of 50.69 ± 13.89 years¹¹.

Among patients with IDH, women were the majority, comprising 63.15% (n=12) compared to 36.84% (n=7) of men, resulting in a sex ratio of 1.9 in favor of women. Nevertheless, a statistically significant association between the incidence of intra-dialytic hypertension (IDH) and gender was not observed (p=0.11). This finding is consistent with studies conducted in United States¹⁴, which also reported similar sex ratios of 2. The average duration of hemodialysis among patients with IDH was $10.17 \pm$

6.05 months. In Group I, 10 patients (52.6%) had undergone dialysis for less than 12 months, compared to 9 patients (47.3%) in Group II. Moreover, the analysis did not reveal any statistically significant evidence indicating a correlation between the occurrence of intra-dialytic hypertension (IDH) and the duration of hemodialysis (p=0.60). This result aligns with the findings of studies conducted by Van Buren et al¹⁵ who also reported no significant associations (p=0.9).

Regarding the per-session volume of ultrafiltration, 14 patients (52.7%) in Group I had a volume exceeding 1 liter, compared to 5 patients (47.3%) in Group II. We observed a statistically significant association (p=0.044) between ultrafiltration volume per session and the occurrence of IDH. This finding is consistent with a study conducted by another researcher.¹⁶

Sixteen out of nineteen patients with IDH did not adhere to their medication regimen before hemodialysis sessions this non-compliance with antihypertensive medication before hemodialysis was significantly associated with intra-dialytic hypertension (IDH) (p=0.001). Similar findings were reported in another study.¹⁷ Additionally, a notable association was observed between IDH and the use of erythropoiesis-stimulating agents (p=0.001), consistent with another study.⁵ Significant associations were also found between IDH and hemoglobin, serum sodium, and serum calcium levels.

CONCLUSION

In conclusion, our study emphasizes the significance of intra-dialytic hypertension as a prevalent and modifiable risk factor in end-stage renal disease (ESRD) patients. Early treatment and management are crucial in mitigating these risks. Further local studies are needed to estimate prevalence and understand the impact on cardiovascular morbidity and mortality in ESRD patients. Implementing targeted interventions can improve health outcomes and quality of life while reducing the burden of these diseases.

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REFERENCES

1. Thomas B, Wulf S, Bikbov B, Perico N, Cortinovis M, De Vacarro KC, et al. Maintenance dialysis throughout the world in years 1990 and 2010. *J Am Society Nephrol* 2015;26(11):2621–33.
2. Hompesch C, Ma TW, Neyra JA, Ripley L, Xiao G, Inrig J, et al. Comparison of Ambulatory Blood Pressure Patterns in Patients with Intradialytic Hypertension and Hemodialysis Controls. *Kidney Blood Press Res* 2016;41(3):240–9.
3. Iatridi F, Theodorakopoulou MP, Papagianni A, Sarafidis P. Intradialytic hypertension: epidemiology and pathophysiology of a silent killer. *Hypertension Research* 2022;45:11.
4. Inrig JK. Intradialytic Hypertension: A Less-Recognized Cardiovascular Complication of Hemodialysis. *YAJKD* 2010;55:580–9.
5. Inrig JK, Oddone EZ, Hasselblad V, Gillespie B, Patel UD, Reddan D, et al. Association of intradialytic blood pressure changes with hospitalization and mortality rates in prevalent ESRD patients. *Kidney Int* 2007;71(5):454–61.
6. Patrice HM, Loïc BE, Hermine F, Pierre NMJ, Denis T, François KF, et al. Intradialytic Hypertension and Associated Factors among Chronic Haemodialysed Patients in Sub-Saharan Africa: An Example from Cameroon. *Open J Nephrol* 2018;08(04):105–16.
7. Gorgulu N, Yelken B, Caliskan Y, Elitok A, Cimen AO, Yazici H, et al. Endothelial dysfunction in hemodialysis patients with failed renal transplants. *Clin Transplant* 2010;24(5):678–84.
8. Baeg SI, Lee K, Jeon J, Jang HR. Management for Electrolytes Disturbances during Continuous Renal Replacement Therapy. Vol. 20, *Electrolyte and Blood Pressure*. Korean Society of Electrolyte and Blood Pressure Research; 2022. p. 64–75.
9. Thavarajah S, Choi MJ. The Use of Erythropoiesis-Stimulating Agents in Patients With CKD and Cancer: A Clinical Approach . Vol. 74, *American Journal of Kidney Diseases*. W.B. Saunders; 2019. p. 667–74.
10. Zhou H, Sim JJ, Shi J, Shaw SF, Lee MS, Neyer JR, et al. β -Blocker Use and Risk of Mortality in Heart Failure Patients Initiating Maintenance Dialysis. *Am J Kidney Diseases* 2021;77(5):704–12.
11. Moustapha F, Tall LA, Yaya K, Moustapha CM, Mohamed SS, Maria F, et al. Intradialytic Hypertension: Prevalence and Associated Factors in Chronic Hemodialysis Patients in Senegal. *Open J Nephrol* 2018;08(02):29–37.
12. Losito A, Del Vecchio L, Del Rosso G, Locatelli F. Postdialysis Hypertension: Associated Factors, Patient Profiles, and Cardiovascular Mortality. *Am J Hypertens* 2016;29(6):684–9.
13. Sebastian S, Filmalter C, Harvey J, Chothia MY. Intradialytic hypertension during chronic haemodialysis and subclinical fluid overload assessed by bioimpedance spectroscopy. *Clin Kidney J* 2016;9(4):636–43.
14. Van Buren PN, Zhou Y, Neyra JA, Xiao G, Vongpatanasin W, Inrig J, et al. Extracellular Volume Overload and Increased Vasoconstriction in Patients with Recurrent Intradialytic Hypertension. *Kidney Blood Press Res* 2016;41(6):802–14.
15. Shamir AR, Karembekar A, Yabes J, Yao Y, Miskulin D, Gassman J, et al. Association of Intradialytic Hypertension with Left Ventricular Mass in Hypertensive Hemodialysis Patients Enrolled in the Blood Pressure in Dialysis (BID) Study. *Kidney Blood Press Res* 2018;43(3):882–92.
16. Flythe JE, Kimmel SE, Brunelli SM. Rapid fluid removal during dialysis is associated with cardiovascular morbidity and mortality. *Kidney Int* 2011;79(2):250–7.
17. Agarwal R, Sinha AD. Cardiovascular protection with antihypertensive drugs in dialysis patients systematic review and meta-analysis. *Hypertension* 2009;53(5):860–6.