

Frequency of Intradialytic Hypertension among Maintenance Hemodialysis Patients: A Single Centre Study

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Abstract

Original Research Article

Introduction: Chronic kidney disease is a public health problem around the world. Worldwide, most patients with end-stage renal disease (ESRD) who can access renal replacement therapy are receiving hemodialysis (HD). Hemodialysis is not a smooth process. It has several complications; intradialytic hypertension (IDH) is one of them. The aim of the study was to determine the frequency of intradialytic hypertension among hemodialysis patients.

Methods: This prospective observational study was conducted at the National Institute of kidney diseases and urology, Dhaka, Bangladesh from November 2021 to April 2022. A total of 249 patients were included in the study. A convenient purposive sampling method was used. **Results:** Only 5(2%) patients received HD whose age was less than 20 and 28 (11.2%) patients were aged more than 60 years of age. Half of the patients were female (127, 51%) and half of the patients were male. Only 15 patients (6%) population had Intra dialytic HTN. Pre-Dialytic, Post-Dialytic, and Intra-dialytic mean blood pressure was 102.78±SD, 62±SD, and 81.74±SD, respectively. Mean ultrafiltration during dialysis was 2789±SD. Mean blood flow during dialysis was 235.17±SD. The relationship between IDH and ultrafiltration and IDH and weight change was weak, positive and insignificant. The relationship between Intradialytic HTN and blood flow was weak, negative and insignificant. **Conclusion:** Intradialytic hypertension is the most important hemodialysis difficulty observed in our country with a higher risk found in subjects with higher weight gain and higher ultrafiltration attentiveness.

Keywords: Intradialytic Hypertension, Hemodialysis, Maintenance, ESRD.

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INTRODUCTION

Chronic kidney disease is a public health problem around the world. It is increasing over time mainly due to an increasing number of diabetic patients and with nearly 30% of the 170 million diabetic patients eventually developing diabetic Nephropathy [1]. A large proportion of patients with chronic kidney disease develop end-stage renal disease (ESRD) with the need for dialysis or kidney transplantation. Worldwide, most patients with end-stage renal disease (ESRD) who can access renal replacement therapy are receiving hemodialysis (HD). In 2015, 124,114 patients initiated treatment for ESRD, 120,972 of who started on dialysis (3,142 start with a kidney transplant). ESRD incidence increased by 94% from 1990 to 2015 and the proportion of the overall incident population starting with a transplant remained at ~2% over the entire period [2]. In

developing countries in Asia, rapid demands for dialysis therapy that have the same standard as those delivered in developed countries have arisen. The end-stage renal disease (ESRD) patients have been increasing in these countries, but every country has its own barriers to promoting better dialysis [3]. Hemodialysis is a life-sustaining procedure for end-stage kidney disease patients, but an accepted consequence of hemodialysis is the tendency for blood pressure (BP) to change frequently both during and between hemodialysis treatments [4]. Large variability in BP measurements during hemodialysis is a risk factor for increased mortality in end-stage kidney disease patients [5]. The adverse outcomes associated with large decreases in BP during hemodialysis are well known [6]. Intradialytic hypotension is an established, common, and risky complication of hemodialysis [1]. However, hypotension is only one component of the abnormal hemodynamic

response to ultrafiltration dialysis; the opposite phenomenon that is, a paradoxical rise in blood pressure (BP) during or immediately after dialysis, intradialytic hypertension is equally common and associated with adverse cardiovascular outcomes [7]. Intradialytic hypertension has a prevalence of $\approx 5\%$ to 15% and predicts cardiovascular mortality [7, 8]. The BP rise during dialysis has a complex mechanistic background and is multifactorial in nature [7, 9]. The clinical significance of intradialytic hypertension lies in the fact that among hypertensive hemodialysis patients, those with intradialytic hypertension appear to have some of the worst outcomes [7]. While the pathophysiology of intradialytic hypertension is uncertain, it is likely multifactorial and includes subclinical volume overload, sympathetic over activity, activation of the renin-angiotensin system, endothelial cell dysfunction, and specific dialytic techniques. Prevention and treatment of intradialytic hypertension may include careful attention to dry weight, avoidance of dialyzable antihypertensive medications, limiting the use of high calcium dialysate, achieving adequate sodium solute removal during hemodialysis, and using medications that inhibit the renin-angiotensin- aldosterone system or which lower endothelin 1 [7].

OBJECTIVES

- **General Objective**
 - To determine the frequency of intradialytic hypertension among hemodialysis patient.
- **Specific Objectives**
 - To find the association of intradialytic HTN with ultrafiltration.
 - To find the association of intradialytic HTN with blood flow.
 - To find the association of intradialytic HTN with weight change.

METHODOLOGY AND MATERIALS

This prospective observational study was conducted at the National Institute of kidney diseases and urology, Dhaka, Bangladesh from November 2021 to April 2022. A total of 249 patients were included in the study according to the following inclusion and exclusion criteria. A convenient purposive sampling method was used. After getting ERC approval, written informed consent will be taken from all patients' attendants or from patients. Using a standardized form, the clinical record was reviewed to gather the information. Blood samples were taken before and after

completion of dialysis to determine urea, creatinine, electrolytes, lipid profile, and blood sugar level. Statistical analyses were performed by using windows based computer software with Statistical Packages for Social Sciences version 25. Prior to the commencement of this study, the research protocol was approved by the Ethical Review Committee of NIKDU, Dhaka.

- **Inclusion Criteria**
 - Patients who give consent to participate in the study.
 - Age 18 above years.
- **Exclusion Criteria**
 - One or more than two HD per week with every session is 4 hours.

RESULTS

Among the study population majority of the patients (78,31.3%) aged between 41-50 were admitted to the hospital, only 5(2%) patients had admitted whose age was less than 20, and 28(11.2%) patients were aged more than 60 years of age. The mean age of the patients was $46.08 \pm SD$. The maximum age was 74 and the minimum age was 18. Half of the patients were female (127, 51%) and half of the patients were male (122, 49%). Around three-fourths (70%) of the study population had Intra dialytic HTN. Pre-Dialytic, Post-Dialytic, and Intra-dialytic mean blood pressure was $102.78 \pm SD$, $62.35 \pm SD$, and $81.74 \pm SD$, respectively. Post-Dialytic mean weight was $59.30 \pm SD$ and minimum recorded weight was 30kg and maximum recorded weight was 101kg. Mean ultrafiltration during dialysis was $2789 \pm SD$ and minimum recorded ultrafiltration was 500ml and the maximum recorded ultrafiltration was 6000ml. Mean blood flow during dialysis was $235.17 \pm SD$ and minimum recorded blood flow was 120ml/min and the maximum recorded blood flow was 350ml/min (Table I). Correlation analysis (Pearson Correlation) was performed to see the association between Intradialytic HTN and ultrafiltration, Intradialytic HTN (IDH) and weight change, and Intra dialytic HTN and blood flow during dialysis. The relationship between IDH and ultrafiltration was weak and the relationship was insignificant and there was a positive relationship. Moreover, the relationship between IDH and weight change and IDH and blood flow during dialysis was weak and insignificant. Therefore, the relationship between IDH and weight change was found negative (Table II).

Table I: Characteristics of Study Population (N=249)

Characteristics	N, %
Age	
<20	5,2%
21-30	23,9.2%
31-40	59,23.7%
41-50	78,31.3%
51-60	56,22.5%
>60	28,11.2%
Mean Age- 46.08±SD Minimum age 18 Maximum age 74	
Gender	
Female	127,51%
Male	122,49%
Intra-Dialytic hypertension	
Yes	15, 6%
No	234, 94%
Pre-Dialytic Mean pressure 102.78±SD	
Post-Dialytic Mean Pressure 62.35±SD	
Intra-Dialytic Mean pressure 81.74±SD	
Post-Dialytic Mean Weight 59.30±SD Minimum 30kg Maximum 101kg	
Pre-Dialytic Mean Weight 62.02±SD Minimum 31kg Maximum 105kg	
Mean Ultrafiltration During Dialysis 2789±SD Minimum 500ml Maximum 6000ml	
Mean Blood Flow ml/min During Dialysis 235.17±SD Minimum 120ml/min Maximum 350ml/min	

Table II: Correlation analysis* of the study population (n=249)

Correlation Pair	Correlation coefficient	p-value
IDH and Ultrafiltration	0.08	P=0.196 ^{ns}
IDH and Weight	-0.02	P=0.717 ^{ns}
IDH and Blood flow	0.06	P=0.312 ^{ns}

*Pearson Correlation

ns= Not Significant

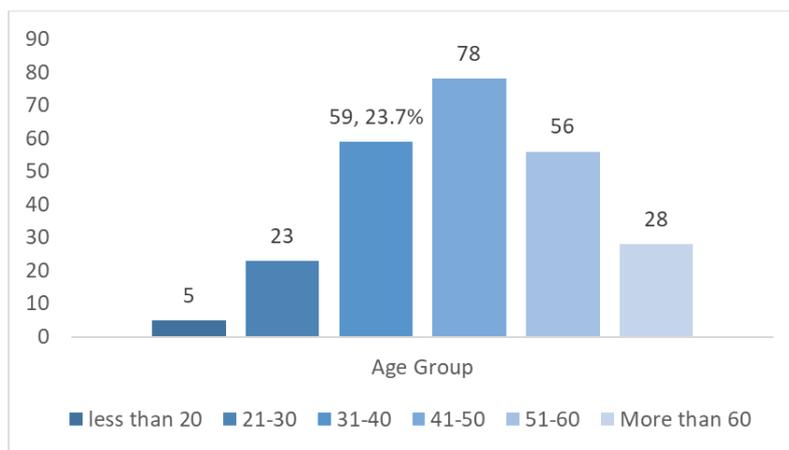


Fig. 1: Bar Diagram Showing Age group of the Study Population (N=249)

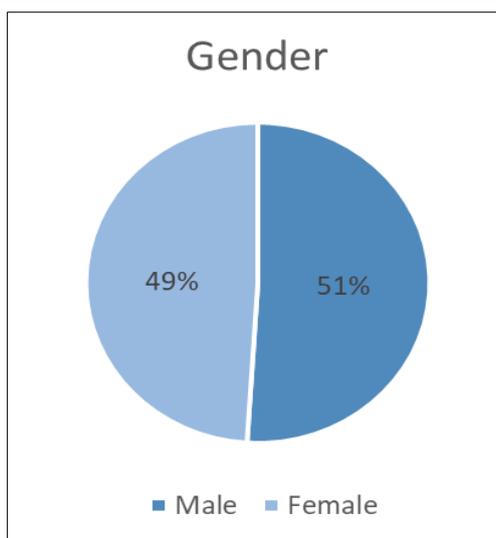


Fig. 2: Pie diagram showing gender distribution of study population (N=249)

DISCUSSION

Intradialytic hypertension is a less recognized acute complication of hemodialysis which has a great impact on cardiovascular morbidity and mortality. About 10-15% of dialysis patients experience intradialytic hypertension. Kaze *et al.*, [10], Amira *et al.*, [11], and Okoye *et al.*, [12] informed a prevalence of 11.1%, 8.5%, and 8.6%, respectively, in their study. In this study 6% (15) had intradialytic hypertension which is near to above mentioned studies. The study showed only 5(2%) patients age was less than 20, and 28(11.2%) patients were aged more than 60 years of age. Similarly, other studies reported age as an associated risk factor for IDH. Sands *et al.*, [13] show that age is a risk factor for IHD. Sánchez-Perales *et al.*, [14] explained the increasing frequency of CVDs with aging. In our present study, half of the patients were female (127, 51%) and half of the patients were male (122, 49%). The presence of females was mentioned as a risk factor for IDH in other studies. Kuiper's *et al.*, [15] in his study, showed that gender was identified as a risk factor. In the present study, Pre-Dialytic, Post-Dialytic, and Intra-dialytic mean blood pressure was $102.78 \pm SD$, $62 \pm SD$, and $81.74 \pm SD$, respectively. Post-Dialytic mean weight was $59.30 \pm SD$ and minimum recorded weight was 31kg and maximum recorded weight was 105kg. Mean ultrafiltration during dialysis was $2789 \pm SD$ and minimum recorded ultrafiltration was 500ml and the maximum recorded ultrafiltration was 6000ml. Mean blood flow during dialysis was $235.17 \pm SD$ and minimum recorded blood flow was 120ml/min and the maximum recorded blood flow was 350ml/min. Zhang *et al.*, [16] showed that the decrease in dry weight was associated with significantly higher decreases in angiotensin-II. Reducing fluid overload in IDH patients with high pre-dialytic BP can effectively improve their BP, but had no effect on BP in normal pre-dialytic BP IDH cases. Armiyati *et al.*, [17] conducted on 112 hemodialysis patients in Semarang showed that the greater the ultrafiltration rate (UFR) the higher the intra-dialysis blood pressure ($r = 0.211 - 0.320$).

The magnitude of UFG is associated with increase in intradialytic systolic ($p=0.024$; $r=0.213$), intradialytic diastolic ($p=0.007$; $r=0.252$) and mean arterial pressure ($p=0.016$; $r=0.227$). High UFR is associated with increase in intradialytic systolic ($p=0.037$; $r=0.211$), intradialytic diastolic ($p=0.001$; $r=0.320$) and mean arterial pressure with $p=0.034$. Ishida *et al.*, [18] showed that hemodialysis connected hypotension caused a severe orthostatic decrease in cerebral blood flow velocity. Tozawa M *et al.*, [19] recently reported that pulse pressure was a prognosticator of mortality. Macias-nunez *et al.*, [20] showed that the main reasons of hemodialysis-associated hypotension include an impaired sympathetic response, old age, atherosclerosis, poor cardiac reserve, and removal of a vast volume of fluid. In our study, we found the relationship between IDH and ultrafiltration and IDH and weight change was weak and the relationship was insignificant and there was a positive relationship. The relationship between Intradialytic HTN and blood flow was weak and the relationship was insignificant and there was a negative relationship. Cirit *et al.*, [21] determined that paradoxical blood pressure increases with ultrafiltration usually. They concluded that after searching dry weight, both BP and post-dialysis weight were reduced; BP reduction was 46/22 mmHg, and post-dialysis weight was reduced by 6.7 kg. Kim *et al.*, [22] showed that there was a linear correlation between high UFR and where UFR was ≥ 10 ml/hour/kg body weight had the highest risk. Hinkle *et al.*, [23] the procedure with intradialytic ultrafiltration hazards reducing the Relative Blood Volume (RBV) and Total Blood Volume (TBV).

Intradialytic hypertension is now acknowledged as a recurrent and persistent phenomenon in hemodialytic patients. There continues to be epidemiologic evidence that IDH is associated with an increased risk for adverse outcomes that is comparable to the patients who have inordinate and striking decreases in BP during hemodialysis.

Patients with IHD might be more chronically volume overloaded than hypertensive hemodialysis patients whose BP decreases during hemodialysis. Perhaps they also appear to have an abrupt increase in vascular resistance that accounts for the BP increase during dialysis. Endothelial cell dysfunction is prevalent in IDH patients, even if it remains irresolute whether Endothelin-1 is the specific mediator of the IDH. Management of IDH patients should include an initial reassessment of dry weight. Patients with persistent IDH should be managed with less dialyzable drugs. Modification of dialysate sodium can be considered, although laboratory and hemodynamics should be monitored carefully [24, 25].

CONCLUSION

Intradialytic hypertension is the most important hemodialysis difficulty observed in our country with a higher risk found in subjects with higher interdialytic weight gain and ultrafiltration attentiveness. Any attempt to achieve better dialysis adequacy including low interdialytic weight gain is required to lower this difficulty. The results of this study can be concluded that a greater increase in interdialytic weight and higher ultrafiltration is a risk factor for the incidence of IDH.

RECOMMENDATIONS

To get robust data, multi-center study should be needed. The purpose of ultrafiltration during hemodialysis must be done carefully and certainly to prevent an increase in intradialytic blood pressure. Caution must be taken to conclude the amount of ultrafiltration during hemodialysis to keep blood pressure stable and the patient's condition safe.

FUNDING

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CONFLICT OF INTEREST

None declared.

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

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