

To Estimate the Incidence of Intradialytic Hypotension in End Stage Renal Disease on Maintenance Hemodialysis and its Correlation with Serum Albumin - A Cross Sectional Study

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Abstract

Background: Intradialytic hypotension (IDH) is considered one of the most frequent complications of haemodialysis treatment and is associated with increased cardiovascular morbidity and mortality. Low serum albumin level frequently documented in the hemodialysis patients, but only few studies were done about the correlation of the serum albumin level and blood pressure changes during hemodialysis, so we planned this study to find out the incidence of intradialytic hypotension during haemodialysis & its correlation with serum albumin level.

Material and methods: 100 patients who have age 18 years and above with diagnosis of chronic kidney disease with end stage renal disease on maintenance hemodialysis thrice weekly, were taken from the dialysis unit after informed consent and after fulfilment of inclusion and exclusion criteria. Blood pressure monitoring was done every 30 min of interval in all subjects for 1 session of the hemodialysis over 4 hours. Biochemical parameters were measured in enrolled subjects before undergoing for the hemodialysis such as, serum albumin, serum creatinine, blood urea, serum sodium, serum potassium. Along with that interdialytic weight gain, blood flow, dialysate flow was also monitored.

Results: 31% subjects had significant fall in BP. Age, gender, associated comorbidities, duration of hemodialysis, blood urea, serum creatinine, serum sodium, blood flow, dialysate flow, interdialytic weight gain (IDWG) had no statistically significant correlation with the intradialytic hypotension (IDH). Mean serum potassium level was increased in IDH group with P value 0.039. Mean serum albumin level in IDH group was decreased with p value 0.003. In IDH group low mean serum albumin and high mean serum potassium level was observed.

Conclusion: We concluded that, incidence of IDH in chronic kidney disease with end stage renal disease on maintenance hemodialysis is 31%. Low serum albumin level and high serum potassium level are a better predictor of the IDH.

Keywords: Intradialytic Hypotension, Hemodialysis, Biochemical Parameters, Comorbidities, Serum Potassium Level

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Introduction

Hemodialysis is a life-saving therapeutic modality used for end stage renal disease (ESRD) patients. It was introduced during the battlefield of korean war. The first hemodialysis was successfully done by Dr. William Kolff [1].

Hemodialysis is a very safe treatment modality, but few acute complications commonly occur during hemodialysis treatment such as hypotension (25%-55%), cramp (5% to 20%), nausea and vomiting (5%-15%), headache (5%), chest pain (2%-5%), back pain (2%-5%), itching (5%), fever and chills (<1%), arrhythmia and dialyser reaction type a & type b [2].

Intradialytic hypotension is the most common complication during hemodialysis and because of this tissue hypoxia, myocardial stunning, ischemic damage to white matter of the brain occur [3]. During hemodialysis there is imbalance between rate of removal of urea, sodium and other osmotically active substances from intravascular compartment and transcellular movement of water & decreased serum albumin may predispose to the development of intradialytic hypotension [4].

Hypoalbuminemia is important risk factor for hypotension during hemodialysis in ESRD patients [5]. Causes of hypoalbuminemia in hemodialysis patient are protein caloric malnutrition due to poor nutritional intake, loss of appetite due to uremia and renal loss [6]. Some studies shows that each 1gm/dl decrease in mean serum albumin level is associated with the development of recurrent cardiac failure and recurrent ischemic heart disease and increases overall mortality [7] few studies showed the correlation of hypoalbuminemia and intradialytic hypotension.

Extensively literature research shows a very few studies are available from north India for the incidence of IDH and its correlation with

albumin. So, this study was planned for estimation of the incidence of intradialytic hypotension in chronic kidney disease with ESRD on maintenance hemodialysis and its correlation with the serum albumin level.

Objective of the Study

The objectives of this study are;

1. Incidence of Intradialytic Hypotension During Haemodialysis
2. Correlation of Intradialytic Hypotension with Serum Albumin Level.

Methods and Materials

Study design Observational descriptive study.

The present study was a prospective observational single centre study and was conducted at tertiary care teaching institute, M.M. Institute of Medical Sciences and research, Mullana, Ambala, Haryana, North India. 100 diagnosed subjects of chronic kidney disease with end stage renal disease on maintenance hemodialysis thrice weekly, were taken from the dialysis unit. The duration of this study was from 2020 to 2022. All the subjects whose age is more than or equal to 18 years was taken after fulfilling the inclusion and exclusion criteria into the study after obtaining the written informed consent. In all subjects detailed history and clinical examination was done.

Inclusion Criteria

- Diagnosed end stage renal disease patient undergoing thrice weekly maintenance hemodialysis.

Exclusion Criteria

- Acute kidney injury
- Patient undergoing hemodialysis for any other cause other than chronic kidney disease like hyperkalemia, severe metabolic acidosis, poisoning

- Patient of other comorbidities like chronic liver disease, tuberculosis.

Before starting the hemodialysis weight measurement, biochemical parameters such as, serum albumin, serum creatinine, blood urea, serum sodium, serum potassium were done in enrolled subjects. Manual Blood pressure monitoring was done every 30 min of interval in all subjects for 1 session of the hemodialysis over 4 hours. Along with that intradialytic weight gain, blood flow, dialysate flow was also monitored.

Operational Definition

Intradialytic hypotension was defined according to Kidney Disease Outcomes Quality Initiative (KDOQI) definition, as a decrease in systolic blood pressure by ≥ 20 mmHg or a decrease in MAP by ≥ 10 mmHg associated with symptoms that include abdominal discomfort, yawning, sighing, nausea, vomiting, muscle cramps, restlessness, dizziness or fainting, and anxiety.⁸

All subjects were categorized in to 1) IDH group and 2) Non IDH group depending upon blood pressure readings during hemodialysis. All the parameters were compared between these two groups.

Statistical Analysis

Data was analysed using Statistical Package for Social Sciences (SPSS) version 21, IBM Inc. Descriptive data was reported for each variable. Summarized data was presented using Tables and Graphs. Data was normally distributed as tested using the Shapero-Wilk W test (p-value was less than 0.05).

Independent t test (two) and One-way anova (three or more) was used for comparison of paired data. Pearson's correlation was used to correlate Serum albumin and Intra dialytic blood pressure. A level of $p < 0.05$ was considered statistically significant.

Results

- Mean age of the study subject was 59.33 ± 13.15 years.
- 28 (28%) were female and 72 (72%) were male.
- 31 (31%) subjects had significant fall in blood pressure during hemodialysis and 69 (69%) patients had no significant fall in blood pressure during HD.
- Majority 26 (84%) of subjects had developed IDH within 1 hour of the hemodialysis.
- Table 1 shows the correlation of various comorbidities with IDH and Non IDH. In this table maximum subjects had correlation with hypertension and diabetes mellitus. And there was no statistically significant correlation between comorbidities and blood pressure changes during hemodialysis.
- Table no 2 shows that, age, blood urea, serum creatinine, serum sodium, blood flow, dialysate flow, interdialytic weight gain had no statistically significant correlation with the intradialytic hypotension.
- P values of serum potassium and serum albumin were 0.039 and 0.003 respectively, which had statistically significant correlation with the intradialytic hypotension.

Table 1

Co-morbidities	IDH (n=31)	Non IDH(n=69)	Total	P-value	Test performed
HTN & DM both	11(17.75%)	51 (82.25%)	62 (100%)		
Hypertension	13 (61.90%)	8 (38.10%)	21 (100%)		
Diabetes mellitus	4 (66.67%)	2 (33.33%)	6 (100%)		
COPD	0 (0%)	1 (100%)	1 (100%)		
Coronary artery	1 (100%)	0 (0%)	1 (100%)	0.878	Chi square test

disease.					
Metabolic syndrome	1 (50%)	1 (50%)	2 (100%)		
HbsAg Positive	1 (100%)	0 (0%)	1 (100%)		
No comorbidity	0 (0%)	6 (100%)	6 (100%)		
Total	31 (31%)	69 (69%)	100(100%)		

Table 2

Sr no	Parameters	IDH (n=31)	Non IDH (n=69)	P-value	Test performed
A	Age	59.36±14.13	59.25±12.59	0.803	Chi square test
B	Sr albumin (gm/dL)	2.806 ± 0.60	3.249 ± 0.69	0.003	
C	Blood Urea (mg/dL)	143.23±35.736	145.48±32.08	0.755	
D	Serum creatinine(mg/dL)	8.441 ± 1.7118	8.1599± 2.05	0.508	
E	Sr Potassium (mEq/Lit)	5.819± 0.71	5.53±0.599	0.039	
F	Sr Sodium (mEq/Lit)	141.1± 4.672	139.06±5.11	0.061	
G	Blood flow in (ml/min)	241.29 ± 17.65	241.88±16.74	0.872	
H	Dialysate flow in (ml/min)	643.55 ± 49.56	633.33±40.82	0.282	
I	Inter dialytic weight gain in (kg)	2.152± 0.54	2.201±0.50	0.658	

Discussion

In our study Mean age of the study subjects was 59.33 ± 13.15 years. 28 (28%) subjects were female, and 72 (72%) subjects were male.

We observed that, 31 (31%) subjects had significant fall in blood pressure during hemodialysis session and 69 (69%) subjects had no significant fall in blood pressure. So, the incidence of IDH was 31% in our study.

Out of 31 subjects in IDH group, 22 (71%) subjects had developed IDH at 30 min, 4 (13%) subjects at 60 min, 2 (6.4%) at 90 min, 1 (3.2%) at 120min and 180 min and 240 min each respectively and none of them had developed IDH at 150min and 210 min. 84% of the subjects were developed IDH within 1 hour of the hemodialysis. So initial 1 hour is very crucial for BP monitoring.

Mean age in Non IDH group patient was 59.36 ± 14.13 years and IDH group was 59.25 ± 12.59 years with P-value 0.803, which was statistically insignificant and no correlation with IDH. M kora, Manohar lal prasad, tayabbi et al found similar results with

our study [5,9,10]. Gender had no significant correlation with IDH in our study and these findings were similar with the M kora et al and Manohar lal prasad et al study [5,9]. Tisler et al, Stefansson et al had found statistically significant p value between gender and IDH, female subjects were more prone for the development of IDH during hemodialysis [11,12].

There was no significant correlation of the comorbidities with IDH in our study. M kora et al observed no significant correlation between comorbidity and blood pressure changes during hemodialysis and but Straver B et al had noticed that diabetes mellitus is a risk factor for IDH (especially if there is autonomic neuropathy) [5,13].

Serum sodium, serum creatinine, blood urea level, blood flow, dialysate flow, interdialytic weight gain had no significant correlation with IDH. M kora et al, Manohar lal prasad et al had same finding with our study [5,9].

Mean value of serum potassium in IDH group was 5.81 ± 0.71 mEq/L and in Non IDH group

was 5.53 ± 0.59 mEq/L with P-value 0.039, which was statistically significant. We found that, subject who developed IDH had higher serum potassium value as compared to Non IDH group subjects. M.kora et al. found no difference between the 2 groups for the serum potassium level [5].

We observed that, mean value of serum albumin level in IDH group was 2.806 ± 0.60 gm/dL and in Non IDH group was 3.249 ± 0.69 gm/dL with P-value 0.003, which was statistically significant. From our study we concluded that serum albumin level in IDH group was significantly lower than Non IDH group. M kora et al and Manohar lal prasad et al had p value 0.002 & 0.001 respectively [5,9]. Chou et al, Al-etreby et al, Ezzat et al, Jason et al found the significant correlation of the low serum albumin level and IDH and these findings were similar with our study [15-17].

Conclusion

From our study, it was concluded that the incidence of IDH in chronic kidney disease with end stage renal disease on maintenance hemodialysis was 31%. Initial 1 hour of hemodialysis is very crucial and needs strict monitoring because during this time majority (84%) of the subjects develop IDH. Age, gender distribution, Serum creatinine, blood urea, blood flow, dialysate flow, serum sodium, IDWG had no statistically significant correlation with the blood pressure changes during hemodialysis.

From this study, we concluded that low serum albumin level and high serum potassium level are better predictors of the IDH. Future recommendations of the study to maintain normal serum albumin level to prevent IDH and intradialytic morbidity and mortality should be evaluated.

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