

## Intradialytic hypotension in dialysis Population

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### Abstract

**Background & Method:** This Study was conducted at Department of General Medicine, NSCB Medical College and Hospital, Jabalpur (MP) on patients coming for dialysis with chronic renal failure from all over mahakaushal area of central India with aim of Intradialytic hypotension in dialysis Population. **Result:** A gradual fall in mean Blood pressure was observed over intradialytic period up to last Post hemodialytic reading. This gradual fall became significantly lower than first mean systolic blood pressure in 90 minute reading and readings after it for Hypertensive group. In Normotensive group fall in mean systolic blood pressure was also significant at 90 minute reading onwards compared to Predialytic measurements. While in Hypotensive patients fall in mean systolic blood pressure showed an early significant fall 60 minute reading onwards compared to predialytic measurements. Fall in mean diastolic blood pressure among Hypertensive group was minute and never significant than predialytic measurement. Similar to hypertensive group mean diastolic blood pressure among Normotensive blood pressure variability group also showed a slight fall but never significant than predialytic measurement. Contrary to the hypertensive and normotensive group the fall in mean diastolic blood pressure was significant at 60 minute reading onwards in Hypotensive study group similar to mean systolic pattern. **Conclusion:** 116 patients we observed major intradialytic BP variation 45.69% patients were Hypertensive (n=53), 37.93% were Normotensive (n=44) and 16.38% were in Hypotensive groups (n=19). As far as morbidity in these intradialytic blood pressure variability groups is concern; Electrocardiographic abnormalities were significantly higher and highest among three groups while hypertensive group showed significantly higher morbidity in ECG compared to normotensive group. Among individual ECG abnormalities Rhythm and sinus abnormalities, Left axis deviation, ST-segment abnormalities, Left and right ventricular hypertrophy, Left bundle branch block, Atrial- and Ventricular premature beats were significantly higher in Hypotensive group. While On the other hand, Q-wave and Right atrial enlargement were significantly higher in Hypertensive group.

**Keywords:** Intradialytic, hypotension & dialysis.

**Study Designed:** Cross Sectional Observational Study.

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### Introduction

The replacement of renal function by hemodialysis (HD) demonstrated for the first time that at least the most vital functions of a complex organ could be replaced by a man-made device. HD revived in the early forties when Willem Kolff where first recovery of a patient undergoing HD for acute renal failure (ARF) was reported by Kolff in 1945 and pioneered by Alwall in Sweden as far back as 1948, became reality in 1960 when Scribner, Quinton et al. designed an external arteriovenous without requirement of permanent anticoagulation.(Jacobs, 2009).

Cardiovascular complications top among the list of complications with the current practices in hemodialysis. Among the cardiovascular complications, 20% to 50% patients experience intradialytic hypotension range which remains an important problem. Another concern is the arrhythmias (5% to 75%), which includes ventricular arrhythmias and ectopics including complex ventricular arrhythmia in 35% patients. The second most common type of arrhythmia is atrial fibrillation with incidence of 27%. Sudden cardiac death accounts for 62% of cardiac-related deaths, usually attributed to arrhythmias[1].

Other common complications include cramps, nausea, vomiting, headache and itching[2,3].

Although cramps, nausea, vomiting, headache and itching do not result in mortality, they substantially deteriorate the quality of life in these patients.

HD is life saving and a generally a safe procedure although acute intradialytic complications are frequently encountered. The common complications include hypotension, muscle cramps, nausea and vomiting, headache, pruritus, fever and chills. Many of the complications are associated with hypotension. Rarely, life-threatening complications such as arrhythmias and other cardiovascular complications occur[4].

Blood pressure (BP) measurement is a fundamental part of hemodialysis (HD) administration with measurements taken before and after HD and at frequent intervals during treatments. It is well-recognized that these peridialytic and intradialytic BP measurements are poorly reflective of interdialytic BP behavior and overall cardiovascular disease burden[5]. BP variability is an increasingly recognized poor prognostic factor in the general population. A growing body of evidence suggests that both short-term and long-term BP variability are associated with adverse events among chronic dialysis patients. Several studies have linked long-term BP variability (considered dialysis treatment to dialysis treatment) to all- cause and cardiovascular morbidity and mortality. Similar results have been demonstrated for short-term (considered as intradialytic) BP variability and clinical outcomes. Further studies substantiating these findings and examining potential BP variability mitigation strategies are needed. Additionally, a BP variability metric that is easily calculated and tracked in the clinical setting is necessary before BP variability can become a routine component of clinical monitoring[6].

### Material & Method

Study was conducted at Department of General Medicine, NSCB Medical College and Hospital, Jabalpur (MP) on patients coming for

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dialysis with chronic renal failure from all over mahakaushal area of central India from March 2019 to August 2020.

#### Inclusion criterion

- Patients who are 18 years or older in age.
- Patients who has renal cause for dialysis (i.e. CRF, ESRD)
- Patient who consented to be a part of study

#### Exclusion criterion

- Patients with other indications for dialysis than CRF/ESRD.
- Patients with vascular access in both upper limbs.
- Patients who have Blood pressure variability due to other causes than CRF/ESRD and Essential HTN-
- Pregnant women
- Patients with liver disease

- Patients who could not undergo direct height and weight measurements
- Patient will not consent to be a part of study

#### Data collection

Proforma for clinical information; history, examination will be used for data collection.

#### Techniques to be used

- For BP measurements standard mercury sphygmomanometer will be used with appropriate cuff size adjusted for patients arm.[6]
- JNC-VII Guidelines will be followed to measure blood pressure.[7]
- Electrocardiogram
- 2D-Echocardiography

#### Results

**Table No. 1 AGE and SEX**

Age Group (years)	Male (n %)	Female (n %)	Total (n %)
<30	22 (27.16%)	7 (20%)	29 (25%)
31-40	16 (19.75%)	9 (25.71%)	25 (21.55%)
41-50	18 (22.22%)	9 (25.71%)	27 (23.28%)
51-60	18 (22.22%)	7 (20%)	25 (21.55%)
61-70	6 (7.41%)	3 (8.57%)	9 (7.76%)
71-80	1 (1.23%)	0 (0%)	1 (0.86%)
<b>TOTAL (N=116)</b>	<b>81 (69.83%)</b>	<b>35 (30.17%)</b>	<b>116 (100%)</b>

Chi-square, df 1.563, 5; P value = 0.9057

Out of all 116 patients, 81 (69.83%) were male while 35 (30.17%) were female with approximate male: female ratio of 7:3. Frequency distribution of the patients among different age groups were comparable in the two sexes ( $p < 0.05$ ). Most common age group among male was <30 years (27.16%), while age group 31-40 and 41-50 years (25.71%) in each group. Only 8 (8.64%) males and 3 (8.53%) were above the age of 60 years of age. Mean age for Hypertensive group was  $40.74 \pm 13.28$  years,  $49.26 \pm 15.22$  years for Normotensive group while  $42.23 \pm 13.03$  years for Hypotensive group. The mean ages for three study groups were comparable ( $p = 0.0633$ ) when compared using Analysis of Variance (ANOVA).

**Table 2: Intra-dialytic blood pressure variability**

Intradialytic Blood Pressure Variability	Number of Patients (%)
Hypertensive	53 (45.69%)
Normotensive	44 (37.93%)
Hypotensive	19 (16.38%)
<b>TOTAL</b>	<b>116 (100%)</b>

Intradialytic variability was observed with Mean Arterial Pressure and Patients were divided into Hypertensive group, Normotensive group and Hypotensive group. The most common variability observed was hypertensive in 53 (45.69%) patients followed by Normotensive in 44 (37.93%) and Hypotensive in only 19 (16.38%) patients.

**Table 3: Intra-dialytic systolic blood pressure (SBP)**

Intradialytic systolic BP (Mean $\pm$ SD)	Hypertensive Group	Normotensive Group	Hypotensive Group	TOTAL
<b>PreHD</b>	152.34 $\pm$ 24.55	145.79 $\pm$ 19.8	155.15 $\pm$ 21.3	150.29 $\pm$ 22.46
<b>30 min</b>	149.91 $\pm$ 22.47	143.71 $\pm$ 20.12	153.09 $\pm$ 21.7	148.07 $\pm$ 21.72
<b>60 min</b>	149.37 $\pm$ 21.48	143.29 $\pm$ 20.72	149.51 $\pm$ 21.9 <sup>a</sup>	147 $\pm$ 21.45
<b>90 min</b>	147.53 $\pm$ 20.52 <sup>b</sup>	141.93 $\pm$ 20.81 <sup>a</sup>	145.78 $\pm$ 22.96 <sup>d</sup>	144.99 $\pm$ 21.25
<b>120 min</b>	147.57 $\pm$ 20.34 <sup>b</sup>	140.26 $\pm$ 19.72 <sup>c</sup>	142.92 $\pm$ 23.78 <sup>d</sup>	143.8 $\pm$ 21.05
<b>150 min</b>	147.06 $\pm$ 20.92 <sup>b</sup>	139.99 $\pm$ 19.97 <sup>c</sup>	141.27 $\pm$ 19.02 <sup>d</sup>	143.17 $\pm$ 20.45
<b>180 min</b>	145.62 $\pm$ 22.35 <sup>d</sup>	139.43 $\pm$ 20.88 <sup>d</sup>	140.27 $\pm$ 19.67 <sup>d</sup>	142.16 $\pm$ 21.47
<b>PostHD</b>	145.88 $\pm$ 22.06 <sup>d</sup>	139.41 $\pm$ 21.38 <sup>d</sup>	139.41 $\pm$ 20.74 <sup>d</sup>	142.1 $\pm$ 21.76

ANOVA (PreHD vs. all); p-value 'a' = <0.05, 'b' = <0.01, 'c' = <0.001, 'd' = <0.0001

The mean systolic blood pressure during intradialytic period was in hypertensive range for all three groups with highest in hypotensive group with  $155.15 \pm 21.3$  mmHg which was significantly ( $p < 0.05$ ) higher than normotensive 30 minute reading and comparable to first reading of Normotensive group. A gradual fall in mean Blood pressure was observed over intradialytic period up to last Post hemodialytic reading. This gradual fall became significantly lower than first mean systolic blood pressure in 90 minute reading and readings after it for Hypertensive group. In Normotensive group fall in mean systolic blood pressure was also significant at 90 minute reading onwards compared to Predialytic measurements. While in Hypotensive patients fall in mean systolic blood pressure showed an early significant fall 60 minute reading onwards compared to predialytic measurements.

**Table 4: Intradialytic diastolic blood pressure (DBP)**

Intradialytic Diastolic BP (Mean $\pm$ SD)	Hypertensive Group	Normotensive Group	Hypotensive Group	TOTAL
<b>PreHD</b>	88.78 $\pm$ 16.98	87.12 $\pm$ 10.36	91.81 $\pm$ 11.75	88.7 $\pm$ 13.82
<b>30 min</b>	88.72 $\pm$ 14.44	87.71 $\pm$ 11.67	91.18 $\pm$ 12.85	88.79 $\pm$ 13.15
<b>60 min</b>	88.58 $\pm$ 13.05	86.57 $\pm$ 12.4	88.14 $\pm$ 13.48 <sup>a</sup>	87.71 $\pm$ 12.9

<b>90 min</b>	88.56 ± 13.09	86.21 ± 12.32	85.83 ± 13.2 <sup>d</sup>	87.11 ± 12.86
<b>120 min</b>	87.7 ± 13.23	87.59 ± 10.88	84.9 ± 12.69 <sup>d</sup>	87.12 ± 12.28
<b>150 min</b>	88.38 ± 13.58	85.89 ± 11.59	83.87 ± 14.11 <sup>d</sup>	86.54 ± 13.04
<b>180 min</b>	88.27 ± 13.05	85.93 ± 12.02	84.41 ± 12.48 <sup>d</sup>	86.61 ± 12.62
<b>PostHD</b>	88.43 ± 13.77	86.7 ± 11.62	85.19 ± 14.24 <sup>d</sup>	87.13 ± 13.1

ANOVA (PreHD vs. all); p-value 'a' = <0.05, 'd' = <0.0001

Fall in mean diastolic blood pressure among Hypertensive group was minute and never significant than predialytic measurement. Similar to hypertensive group mean diastolic blood pressure among Normotensive blood pressure variability group also showed a slight fall but never significant than predialytic measurement. Contrary to the hypertensive and normotensive group the fall in mean diastolic blood pressure was significant at 60 minute reading onwards in Hypotensive study group similar to mean systolic pattern.

#### Discussion

According to major intradialytic BP variation 45.69% patients were Hypertensive, 37.93% were Normotensive and 16.38% were in Hypotensive groups in our study. Inring (2010) studied intradialytic hypertension and found a prevalence of 15% of hemodialysis patients[7]. This is lower than the prevalence our study may be owing to definition of hypertension used in study was systolic BP while we use MAP rise for defining hypertension. Van Buren et al. (2012), studied all patients from our outpatient hemodialysis units in retrospective cohort study and found a prevalence of intradialytic hypertension was 21.3%[8]. Buren et al. also had lower prevalence of intradialytic hypertension. Flythe et al. (2015) found a variable prevalence of 10–70% intradialytic hypotension[9]. Low BP during HD has been associated with a range of clinical and pathogenic consequences including inadequate dialysis dose, myocardial stunning, brain atrophy, vascular access thrombosis and increased mortality[5]. Sands et al. (2014) studied intradialytic hypotension in 44,801 treatments in 1137 patients and found a prevalence of 17.2% of all treatments and 11.1–25.8% at facility level[10]. Those results from Flythe et al. and Sand et al. Out of all 116 patients, 81 (69.83%) were male while 35 (30.17%) were female with approximate male:female ratio of 7:3. Hemachandar (2017) reported mean age of the HD population was 50.05 ± 13.80 years. Where Males constituted 79.52% while females constituted 20.48% in our study cohort[11]. Those results were in synopsis with our results.

Johnson et al. (2013) in National health and nutrition examination survey found 48.2% patients were up to 44 years of age and we had 36.55% patients up to the age of 40 years, while patients from 44–64 years were 33.6% and patients in older age groups was relatively less patients on dialysis, which was similar to our study[12].

While with data of Dialysis Clinic Inc. Rohrscheib et al. (2008) showed lower number of patients in age group less than 44 years of age with 14.5% patients and 37.2% in 45–64 years of age. They also have a higher proportion of older patients in there study which was contrasting to our results[13].

Proportion of Males were highest in the Hypotensive group with 84.21%, followed by 69.81% males in Hypertensive group however it was similar to all patient sex ratio, while lowest males proportion was in normotensive group with 63.64% males. However, the proportional distribution for two sexes was comparable among three study groups (p>005).

The most common job description among dialytic patients was Housewife with 33 (28.45 %) patients, followed by 32 (27.59 %) skilled worker, 26 (22.41 %) Hand worker, 19 (16.38 %) were students and only 6 (5.17 %) were government employee. Out of all our patients 101 (87.07%) were married while small proportion of 15 (12.93%) patients was unmarried. The most common etiology for chronic renal failure in our patients being Diabetic Nephropathy with 47 (40.52%) patients, followed by Hypertensive Nephropathy in 26 (22.41%), Unknown Causes in 18 (15.52%), Chronic Glomerulonephritis in 13 (11.21%), Obstructive Nephropathy in 8 (6.9%) and Chronic Pyelonephritis in 4 (3.45%) patients.

#### Conclusion

116 patients we observed major intradialytic BP variation 45.69% patients were Hypertensive (n=53), 37.93% were Normotensive

(n=44) and 16.38% were in Hypotensive groups (n=19). As far as morbidity in these intradialytic blood pressure variability groups is concern; Electrocardiographic abnormalities were significantly higher and highest among three groups while hypertensive group showed significantly higher morbidity in ECG compared to normotensive group. Among individual ECG abnormalities Rhythm and sinus abnormalities, Left axis deviation, ST-segment abnormalities, Left and right ventricular hypertrophy, Left bundle branch block, Atrial- and Ventricular premature beats were significantly higher in Hypotensive group. While On the other hand, Q-wave and Right atrial enlargement were significantly higher in Hypertensive group.

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