

# A prospective interventional study on increasing the volume of fluid removal during hemodialysis for patients with Intra-dialytic hypertension (IDH) in a south Indian tertiary care hospital

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## Abstract

**Background:** Intra-dialytic hypertension (IDH) pose a great threat in patients on dialysis and proper intervention could prevent its related complications. The aim of this study was to identify the risk factors and drug interventions for IDH.

**Methods & Results:** Patient attending the nephrology departments of tertiary care hospital were divided in to group A exhibiting intra-dialytic hypertension on Telmisartan 40 mg BD, group B without intra-dialytic hypertension dialyzed with dialysate Na<sup>+</sup> 130mg and group C dialyzed with intensive ultrafiltration for the last three months of the study.

**Statistics:** Paired sample t- test. Post hoc analysis with one - way anova - Bon Ferroni

**Results:** The results suggest that there were 84 (43.97%) patients undergoing hemodialysis, 74 (38.74%) were having hypertension and (33) 17.27% had IDH. In this study, 12 (6.28%) were patients with IDH out of which 3 (1.57) dies, whereas 2 (1.02) were patients without IDH and none died. Average intra-dialytic rise in BP pre-treatment were 26/12, 26/14 and 28/16 mmHg for group A, B and C respectively. Average intra-dialytic rise in BP post-treatment were 16/10, 18/08 and 12/04 mmHg for group A, B and C respectively. Paired sample t-test. Post hoc analysis with one-way analysis of variance (ANOVA) - Bon Ferroni showed significant value of 0.001 for before treatment - after Telmisartan, 0.002 for before treatment - after low Sodium dialysis and 0.000 for before treatment - after excess fluid removal. In interventions, the mean  $\pm$  SD was 1.0 $\pm$  0.023 for Telmisartan/ low sodium intensive ultrafiltration, 1.0 $\pm$ 0.02 for low sodium / Telmisartan excess fluid removal and 0.023 $\pm$ 0.02 for excess fluid removal / Telmisartan low sodium.

**Conclusion:** Most effective method to decrease the intra-dialytic hypertension is to increasing the volume of fluid removal during hemodialysis

**Keywords:** Excess fluid removal, Low Sodium dialysis, Intra-dialytic hypertension, Telmisartan

## Introduction

Rise in blood pressure during hemodialysis is known for several years, there are no clear accepted criteria to define intra-dialytic hypertension. In few studies, intra-dialytic hypertension was defined as in mean arterial pressure rise of >15 mm Hg within or immediately post dialysis<sup>1</sup>.

Few studies suggest a lower threshold of >10 mm Hg increase in systolic pressure and in some an inclusive definition was adopted (BP rise of any degree during the second or third intra-dialytic hour)<sup>2-4</sup>.

The mechanism background of intra-dialytic hypertension is complex and few are volume overload, intra-dialytic sodium gain, renin system activation, sympathetic nervous system activation etc.<sup>5</sup>

The aim of the study was to assess risk factors for the development of intra-dialytic hypertension in our patients, risk factors for the development of intra-dialytic hypertension in our patients and drug intervention to improve the outcome.

## Materials and Methods

Institutional human Ethics committee approval was obtained from Pushpagiri Medical College Hospital Thiruvalla and informed consent was taken from all the patients. It is a prospective controlled study of seven months. Patient were divided in to group 1 exhibiting intra-dialytic hypertension

who were Telmisartan 40 mg BD, group 2 without intra-dialytic hypertension dialyzed with dialysate Na<sup>+</sup> 130mg and group 3 dialyzed with intensive ultrafiltration for the last three months of the study.

## Statistics

Paired sample t- test. Post hoc analysis with one - way anova - Bon Ferroni

## Results

**Table. 1**

Parameters	Number	Percentage
Total number of patients undergoing hemodialysis	84	43.97
Number of patients having hypertension	74	38.74
Number of patients having intra-dialytic hypertension	33	17.27
Total	191	100

**Table 1** Depicts total number of patients undergoing hemodialysis with percentage of 43.97, Number of patients having hypertension with percentage of 38.74 and Number of patients having intra-dialytic hypertension with 17.27. This concludes that, maximum numbers of patients were

undergoing hemodialysis and patients having intra-dialytic hypertension were less in this study

**Table. 2** Shows variables of the patients with and without IDH

Variable	Patients with IDH	Patients without IDH
Age	30 ± 10	24 ± 8
BMI	19 ± 2	22 ± 2
Inter-dialytic weight gain.	3	2
Mean Hb	6.1	8.4
Mean se.cr	14.4	15.5
Mean Na <sup>+</sup>	134	130
Mean K <sup>+</sup>	4.5	4.9
Mean Ca <sup>2+</sup>	7.5	8.2
Mean Phosphate	8.4	6.3
Erythropoietin dose	10,000	6,000
Avg. number of antihypertensive medications	4	2

IDH- Intra-Dialytic Hypertension

**Table. 3**

Variable	Patients with IDH	Percentage	Patients without IDH	Percentage
No of hospital admissions	12	6.28	2	1.04
No of patients died	3	1.57	0	0

**Table. 4**

Parameter	Group A	Group B	Group C
Average intra-dialytic rise in BP pre-treatment	26/12	26/14	28/16
Average intra-dialytic rise in BP post-treatment	16/10	18/08	12/04

IDH- Intra-dialytic Hypertension.

**Table. 3** Shows No of hospital admissions and No of patients died which was seen more in Patients with IDH (1.57%) and none died without IDH

**Table. 4** Shows average intra-dialytic rise in BP pre-treatment which was more in Group C compared to Group A & B, whereas average intra-dialytic rise in BP post-treatment more in Group B followed by Group A and least was seen in Group C.

**Table 5**

Parameter	Mean	Std. deviation	Std. error mean	Sig (2 tailed)
Before treatment - after Telmisartan	8.167	6.46	1.86	0.001
Before treatment – after low Sodium dialysis	8.00	6.87	1.92	0.002
Before treatment – after excess fluid removal	16.33	7.83	2.24	0.000

Paired sample t- test. Post hoc analysis with one-way analysis of variance (ANOVA) - Bon Ferroni

**Table. 5** Shows results of Paired sample t- test. Post hoc analysis with one-way analysis of variance (ANOVA) - Bon Ferroni with significant with before treatment – after excess fluid removal (2 tailed p value of 0.000), but was 0.002 for before treatment – after low Sodium dialysis and 0.001 for before treatment - after Telmisartan.

**Table 6**

Interventions	Observation	Mean±SD
Telmisartan	Low sodium Intensive ultrafiltration	1.0±0.023**
Low sodium	Telmisartan Excess fluid removal	1.0 ±0.02**
Excess fluid removal	Telmisartan Low sodium	0.023±0.02***

Observations are Mean±SD. p < 0.05 considered significant.  
\*\* Significant, \*\*\* Highly Significant

**Table. 6** shows observations of low sodium intensive ultrafiltration, Telmisartan excess fluid removal Telmisartan low sodium which was 1.0±0.023, 1.0 ±0.02 and 0.023±0.02 respectively.

## Discussion

Intra-dialytic hypertension affects up to 40 % of hemodialysis patients. Intra-dialytic hypertension occurs more frequently in patients who are older, have lower BMI, with higher inter-dialytic weight gain, lower hemoglobin values, receiving higher erythropoietin dosage, on more antihypertensive medications, and with lower serum creatinine levels. Patients exhibiting intra-dialytic

hypertension have higher morbidity and mortality. Most effective method to decrease the intra-dialytic hypertension is increasing the volume of fluid removal during hemodialysis. A multi-pronged strategy may be the best to tackle the menace of Intradialytic hypertension. It is evident in this study that volume removal of the fluid during hemodialysis will increase the therapeutic effectiveness of the antihypertensive drug and better outcome results of the treatment.

In this study number of hospital admissions and number of patients died was seen more in Patients with IDH (1.57%) and none died without IDH

Average intra-dialytic rise in BP pre-treatment were 26/12, 26/14 and 28/16 mmHg for group A, B and C respectively in this study between average intra-dialytic rise in BP pre-treatment and average intra-dialytic rise in BP post-treatment.

The parameter related to electrolyte considered in this study were Na<sup>+</sup>, K<sup>+</sup>, Ca<sup>2+</sup> and Potassium as compared study done by Chi-Young Choi et al.<sup>6</sup> which included serum potassium levels including other parameters like arm muscle area and ultrafiltration which was more than two times higher mortality rate in IDH group than non-IDH Group.

Mortality rate was 1.57% in this study at 6 months as compared to 7% and increased to 15.5% at 12 months by a study done by Gajanan Kale et.<sup>7</sup>

The results after applying paired sample t- test followed by post hoc analysis with one-way analysis of variance (ANOVA), Bon Ferroni was significant with before treatment – after excess fluid removal (2 tailed p value of 0.000), but was 0.002 for before treatment – after low Sodium dialysis and 0.001 for before treatment - after Telmisartan compared to study done by Chi-Young Choi et al.<sup>8</sup> which showed non-significance with Valsartan, Losartan, Candesartan, Telmisartan, Carvediol, Nifedipine, And Amlodipine between the IDH and non-IDH groups.

## Conclusion

This study indicates that increasing the volume of fluid removal during hemodialysis in patient with intra-dialytic hypertension is a good method to improve the therapeutic effectiveness.

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## Conflict of Interest

None.

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