FACTORS CONTRIBUTING TO RESISTANT HYPERTENSION IN HEMODIALYSIS PATIENT – A SINGLE CENTERED AMBIDIRECTIONAL COHORT STUDY

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ABSTRACT: In Hemodialysis patients, Resistant hypertension is one of the common complication with higher risk of CVS mortality. Our study focus on hemodialysis group of people with resistant hypertension. Aim of study is to evaluate the factors contributing to resistant hypertension in hemodialysis patients. Group of 137 patients who meet the inclusion criteria at a tertiary care hospital were selected in our Ambidirectional Cohort study. Patients are categorized based on age, gender, dialysis duration, risk factor. Berlin Questionnaire, Morinsky Medication Adherence Scale [MMAS] were used during the study to assess Obstructive sleep apnea [OSA] & Medication Adherence of the patient. Through our study, we have observed that the risk factors like Non adherence of medication, Obstructive sleep apnea, Excessive water intake, Inter dialytic weight gain, Edema and with hold of antihypertensive drugs and in the age group 51-60 years category are at high risk in developing the resistant hypertension. We have also found that blood pressure variations were found more in the patients with multiple risk factors when compared with single risk factor type.

INDEX TERMS: Resistant hypertension, Berlin Questionnaire, Morinsky Medication Adherence Scale, Obstructive sleep apnea

INTRODUCTION

Hemodialysis patients are vulnerable to serious complications thus resistant hypertension is one such factor seen in most of the patients. It is a condition where the blood pressure is in elevated range i.e., > 140 SBP and > 90 DBP even by the use of 3 anti hypertensive drugs which includes a diuretic. If not controlled and treated, it can lead to serious complications and even death. Factors that can lead in causing Resistant Hypertension are Genetics, Pseudo resistance [Improper blood pressure monitoring, Poor drug adherence ], Lifestyle factors like obesity, excess salt intake, Drug induced like NSAID’s, Erythropoietin, Cyclosporine and diseases like CKD, Obstructive sleep apnea, Hyperparathyroidism etc., Based on age, the patients were classified and included in the study. The important risk factors in contributing the resistant hypertension in hemodialysis patients are Obstructive sleep apnea, Edema, Non adherence to medications, excess water intake. Other factors like excess salt intake, inter dialytic weight gain and with hold of anti hypertensive drugs are also leading to resistant hypertension. We have also observed that most of the commonly used antihypertensive drugs in resistant hypertension are diuretics, beta blockers, calcium channel blockers.

MATERIALS AND METHODS

STUDY SITE:- The study was done on the hemodialysis patients in Vedanta Hospitals, Guntur-522001
STUDY DESIGN :-Ambidirectional Cohort study (An Observational Study)
STUDY POPULATION:- The study included adult patients (both males and females) from age group above 20 years and undergoing hemodialysis for the past 1 to 3 years and who were diagnosed with Resistant Hypertension
STUDY PERIOD :-The study was carried out for 6 months from December 2021 to June 2022 at Vedanta Hospitals, Guntur
SAMPLE SIZE: - 137 samples
STUDY CRITERIA:-
INCLUSION CRITERIA:-
• Patients who are on dialysis and are suffering from hypertension
• Age ≥20 years
• Patients diagnosed with either CKD and ESRD
• Patients received haemodialysis for ≥ 1 year to ≤ 3 years
• Patients who are on haemodialysis at least twice weekly with atleast 3 hours per session
EXCLUSION CRITERIA:-
- Patients who are not willing to participate in the study
- Patients who are non-cooperative to communicate with the interviewer
- Patients with age group < 20 years
- Patients who are receiving haemodialysis less than 3 hours and below 2 sessions a week
- Patients who are on Hemodialysis but not diagnosed with hypertension.
- Pregnant women

STATISTICAL INFORMATION :-
- Raw Data is collected through Patient Proforma and its entry is done in Excel – 2015 version
- Statistical analysis is done by using the SPSS software

SOURCES OF DATA :-
Patient Proforma’s, Treatment Charts, Questionnaire Survey’s, Blood pressure monitoring, Asking the Physician, Patient’s and their attendants and other relevant sources

FOLLOW-UP:-
The Patients were counselled twice a week. For every follow up, the blood pressure fluctuations were monitored along with their health condition. Phone calls were also done to gather proper and accurate information

RESEARCH HYPOTHESIS:- A total of 137 patients were included in the study during the period from December 2021 to June 2022 [N=137], Out of them n=49 are having resistant hypertension and among them n=38(77.55%) were males and n=11(22.4%) were females. The Table-4 describes the significant P values of age and risk factor analysis in treatment, control and overall groups. We have observed that there is a significant contribution of age and risk factors in leading resistant hypertension in the treatment group people.
Figure 4: Gender Distribution in RHTN Patients

Male: 77.55%
Female: 22.4%

Figure 5: RHTN Distribution in hemodialysis patient

Yes: 35.7%
No: 64.2%

Figure 6: Age Distribution in RHTN Patients

Age (in years) vs Frequency:
- 21-30: 6.12%
- 31-40: 24.4%
- 41-50: 18.3%
- 51-60: 30.6%
- 61-70: 16.3%
- 71-80: 4.08%
- 81-90: 4.08%
Figure 7 Risk Factor Distribution in RHTN patients

Figure 8 Relation of Risk Factor Distribution in RHTN Patients

Figure 9 Assessment of Factors in Non RHTN patients
### Table 1: Relation Between HTN Duration, Dialysis Duration and RHTN

<table>
<thead>
<tr>
<th>HTNDURATION</th>
<th>No. of patients</th>
<th>DIALYSES DURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>1-5 years</td>
<td>35</td>
<td>25.5</td>
</tr>
<tr>
<td>6-10 years</td>
<td>28</td>
<td>20.4</td>
</tr>
<tr>
<td>11-15 years</td>
<td>23</td>
<td>16.7</td>
</tr>
<tr>
<td>16-20 years</td>
<td>19</td>
<td>13.8</td>
</tr>
<tr>
<td>20-25 years</td>
<td>20</td>
<td>14.5</td>
</tr>
<tr>
<td>&gt;25 years</td>
<td>12</td>
<td>8.7</td>
</tr>
</tbody>
</table>

### Table 2: Prescribing Pattern of Antihypertensive Drugs In RHTN patients

<table>
<thead>
<tr>
<th>CLASS OF ANTIHYPERTENSIVE</th>
<th>FREQUENCY</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centrally acting agents</td>
<td>28</td>
<td>57.1%</td>
</tr>
<tr>
<td>Beta Blockers</td>
<td>38</td>
<td>77.5%</td>
</tr>
<tr>
<td>Diuretics</td>
<td>49</td>
<td>100%</td>
</tr>
<tr>
<td>Calcium channel blocker</td>
<td>35</td>
<td>71.4%</td>
</tr>
<tr>
<td>ACE’S</td>
<td>5</td>
<td>10.2%</td>
</tr>
<tr>
<td>ARB’S</td>
<td>10</td>
<td>20.4%</td>
</tr>
<tr>
<td>Vasodilators</td>
<td>4</td>
<td>8.1%</td>
</tr>
</tbody>
</table>

### Table 3: Drug Therapy Combination in RHTN patients

<table>
<thead>
<tr>
<th>COMBINATION</th>
<th>FREQUENCY</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCB’S + Beta Blockers + diuretics</td>
<td>19</td>
<td>38.7%</td>
</tr>
<tr>
<td>Beta Blockers + Diuretics + Centrally acting agents</td>
<td>10</td>
<td>20.4%</td>
</tr>
<tr>
<td>Centrally acting agents + diuretics + CCB’S</td>
<td>20</td>
<td>40.8%</td>
</tr>
</tbody>
</table>
RESULTS

We had conducted this study to identify the factors contributing to resistant hypertension in hemodialysis patients. The study was planned and carried out from December 2021 to June 2022. 137 patients were included in the study. The age distribution data (Figure 1) of the patients have demonstrated that the highest frequency was found in the 41-50 years age group with 38 patients (27.7%) followed by the 51-60 age group with 37 patients (27%). The P value of age distribution was (P=0.170).

Through our study we have found that 109 patients (79.56%) were males and 28 patients were females. From this we have identified that more males were undergoing hemodialysis when compared with females. (Figure 2)

The dialysis duration distribution (Figure 3) shows that 86 patients (62.7%) were undergoing hemodialysis in between 25-36 months. Through our study we observed that males (38 patients, 77.55%) were more prone to resistant hypertension when compared to females (11 patients, 22.4%) (Figure 4)

From 137 patients we found that 49 (64.2%) hemodialysis patients were diagnosed with resistant hypertension. (Figure 5) The analysis of age group distribution in resistant hypertensive patients demonstrated that 3 patients (6.12%) were in 21-30 years, 12 patients (24.4%) were in 31-40 years, 9 patients (18.3%) were in 41-50 years where as 15 patients (30.6%) were in 51-60 years, 16.3%, 4.08% were in 61-70, 71-80 year respectively. From this data we have observed that highest frequency was found in the age group of 51-60 years. (Figure 6)

The Figure 7 (RHTN risk factors) demonstrated that Obstructive sleep apnea (24 patients, 49% with P value of 0.0001) was the major risk factor that contributed to resistant hypertension and the remaining factors are as follows

- The Non adherence to medication as a factor was found in 23 patients (46.9%) with P value of 0.0002.
- The Excessive water intake as risk factor was found in 13 patients (26.5%) with P value of 0.0001.
- The Edema as factor contributed to RHTN was found in 24 patients (49%) with P value of 0.0032.
- The Interdialytic weight gain was found in 7 patients (14.3%) with P value of 0.0190.
- Withholding of anti hypertensives was found in 12 patients (24.5%) with P value of 0.0001
- The Excessive salt intake was found in 4 patients (8.2%) with P value of 0.066

The Figure 8 (risk factor relation in RHTN patients) demonstrated that there is a proportionality between number of factors and blood pressure of the patient. From this we have observed that an individual patient was affected with more than one risk factor. From this we observed that patients with 5 factors had blood pressure range between 180-190 mmHg.

In our study among non resistant hypertensive hemodialysis patients we found that most of the patients were on no withholding of antihypertensives (87patients, 98.8%), salt reduction ( 86patients, 97.7%), no inter dialytic weight gain (85 patients,96.5%)
Without obstructive sleep apnea (84 patients, 95.4%), limited water intake (83 patients, 94.13%) and adherent to prescribed medication (81 patients, 92.04%). (Figure 9)

Among nonresistant hypertensive hemodialysis patients, the risk factors like nonadherence to medication, obstructive sleep apnea, with excessive salt intake, excessive water intake, interdialytic weight gain and with holding of antihypertensive drugs were not significant.

We have also evaluated the relation between hypertension duration and resistant hypertension. From this we observed that the patients with more than 15 years of HTN duration were more prone to RHTN.

**DISCUSSION**

In the present study, 137 hemodialysis patients were included and among them 49 patients were diagnosed with resistant hypertension and 88 patients were non-resistant hypertensive patients and the risk factors contributing to resistant hypertension in hemodialysis patients were also examined. According to the study, the patients of 51-60 years age group have a higher incidence of getting resistant hypertension when compared with other age groups. In addition, the risk factors such as obstructive sleep apnea, edema, non-adherence to medications has showed a high incidence of resistant hypertension in hemodialysis patients.

In our study we have also evaluated that excessive salt intake is not a significant factor in resistant hypertensive hemodialysis patients. There are certain limitations in this study like not including Non-hemodialysis patients with resistant hypertension thus, it may benefit by increasing the sample size and allowing significant treatment patterns to be properly examined.

In this study, we have also observed that patients suffering with two or more risk factors have a higher incidence of getting resistant hypertension. The main objective of the study is to analyze the factors which contribute resistant hypertension and to reduce the incidence of the resistant hypertension in these patients.

**CONCLUSION**

The purpose of this study is to broaden the understanding on resistant hypertension by looking at the prevalence of risk factors among the patients undergoing hemodialysis with resistant hypertension. The study has identified several risk factors which lead to resistant hypertension which includes nonadherence to medications, obstructive sleep apnea, excessive water intake, interdialytic weight gain, edema, with holding of anti hypertensives. Hemodialysis patients are more likely to develop resistant hypertension especially in the age group of 51-60 years. Excessive salt intake did not contribute to resistant hypertension in hemodialysis patient and we also conclude that variations in blood pressure were high in patients with multiple factors when compared to individual with single factor. We also conclude that the most commonly used antihypertensive drugs in resistant hypertension were diuretics, beta blockers, calcium channel blockers.

**REFERENCES**