Intradialytic Hypertension: Prevalence, Characteristics and Associated Factors in Chronic Haemodialysis Patients at Kenyatta National Hospital Renal Unit

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Abstract

Background: End Stage Renal Disease (ESRD) is increasingly being diagnosed in our set up with a number of patients being put on haemodialysis. These patients have an age adjusted mortality rate of 3-10 times that of the general population. Cardiovascular causes account for more than 50% of death intra dialysis. Intradialytic Hypertension (IDH), defined as an increase in systolic blood pressure by at least 10 mmHg from pre to post haemodialysis readings in a minimum of four out of six consecutive dialysis sessions is recognized as an independent cardiovascular risk factor. Despite cardiovascular causes accounting for more than 50% of death intra dialysis and IDH being an independent cardiovascular risk factor, there is no local data on its prevalence, patient characteristics and associated factors. This study was meant to provide us with the information that we hope will be used to improve patient outcome on haemodialysis and decrease mortality at the renal unit.

Objectives: The aim of this study was to determine the prevalence of Intradialytic Hypertension (IDH) in End Stage Renal Disease (ESRD) patients undergoing haemodialysis at Kenyatta National Hospital Renal Unit. The secondary objective was to compare selected patients’ characteristics and associated factors between those with and without IDH.

Design: This was a cross sectional study done at Kenyatta National Hospital (KNH) Renal Unit over a period of 3 weeks.

Methodology: The study population were adults aged over 18 years on maintenance haemodialysis and who were willing to provide a written consent. All those who met the inclusion criteria were enrolled. Blood pressure was measured using BP machines of the Omron®/Spengler® types for six consecutive dialysis sessions (Pre and Post dialysis) on each of the participants. The fluid status was assessed at the beginning of the study using a Bio Impedance Spectroscopy whose data was analysed using the BC4 software. All those who were recruited had blood samples drawn at the beginning of the study for analysis of serum electrolytes and haemoglobin level at the renal lab in KNH. All data was analysed using SPSS. The prevalence of IDH was calculated, Chi square test was used to test for association between IDH and associated factors with P value and Confidence intervals being calculated where necessary.

Results: Our study involved 512 haemodialysis sessions in 86 Chronic Kidney Disease (CKD) patients with a mean age of 47.3±13.5 years and a sex ratio (M/F) of 1.5:1. The mean duration of dialysis was 6 months to 1 year. The average haemoglobin level was 8.6±1.9g/dl. The mean sodium concentration pre dialysis was 135.6±6.7mmol with a gradient of 4.4±6.7 mmols while that for potassium was 4.7±0.9mmols with a gradient of -2.9±1.1mmols. More than half 45(52.3%) of the study participants had gross fluid overload with an average hydration status pre dialysis of 14.8±7.3%. Most of the study participants were on two antihypertensive medications with CCBS (93.3%) being the drug of choice in our set up. The prevalence of IDH was 51.2%. Factors found to affect IDH in our set up were high pulse pressure and high SBP.

Conclusion: IDH is often neglected despite it being recognized for many years. This study clearly shows that it is common in our cohort of haemodialysis patients with most of them having gross fluid overload. Its management is essential and should possibly incorporate adequate management of fluid status in these patients.

Key words: Intradialytic hypertension, Haemodialysis, End stage renal disease

Introduction

Intradialytic Hypertension (IDH) is defined as systolic blood pressure increase by at least 10 mm Hg from pre to post haemodialysis readings in a minimum of four out of six consecutive haemodialysis sessions (1). It has a general prevalence of 5-15% amongst patients on haemodialysis (2,3). Prevalence figures of 22% and
28% have been reported in Senegal and South Africa respectively (4,5).

Probable pathophysiological mechanisms include; (i) Fluid overload, (ii) Renin Angiotensin Aldosterone System (RAAS) and sympathetic nervous system over activation, (iii) Removal of antihypertensive medications during dialysis, (iv) Endothelial dysfunction, (v) Electrolyte imbalance involving dialysate sodium, calcium or potassium, (vi) Treatment with erythropoietin. Modalities aimed at the various postulated mechanisms causing IDH have been used in treatment with varied levels of success.

There is a 6% increase in mortality over 2 years with every 10mmhg increase in blood pressure during haemodialysis (6). IDH increases cardiovascular burden with resultant more left ventricular hypertrophy in these patients. IDH in End Stage Renal Disease (ESRD) compared to normotensive patients' intra dialysis is associated with more microvascular disease and interstitial fibrosis (7).

Approximately 60-80% of patients are hypertensive at time of diagnosis of ESRD, Up to 75% are reported to have left ventricular hypertrophy pre dialysis (8). Intradialytic blood pressure recordings give a more accurate estimation of biometric load on the arterial tree in haemodialysis compared to inter dialytic blood pressure readings (9). Cardiovascular disease accounts for more than 50% of ESRD deaths intradialysis. Left ventricular hypertrophy and dilation are associated with increased cardiovascular related mortality hence the need for aggressive identification and treatment of all patients at risk (10).

IDH has been recognized as a marker of fluid overload in Chronic Kidney Disease (CKD) patients on haemodialysis. There are various methods of assessing fluid overload: Invasive and non-invasive. Both do have various limitations. Bio impedance is practical, easy to use, precise, highly reproducible and compares favourably well with other methods in assessing fluid overload in haemodialysis patients (11–14).

Sepsis, fluid overload and inadequate dialysis with electrolyte imbalance are equally important causes of mortality in haemodialysis in the developing countries as opposed to cardiovascular causes and coronary artery disease in the developed ones (15–17).

Materials and methods

This was a cross sectional study conducted at Kenyatta National Hospital Renal Unit. KNH is a teaching and referral hospital located in Nairobi. It also serves as a primary care centre to most residents of the city. It is a referral hospital to the Kenyan health facilities and other countries in Sub-Saharan Africa (SSA). It has a bed capacity of 1800.

Renal services were started at KNH in 1972 with the current renal unit being opened in 1984, approximately a total of 250-300 patients are seen every month with 10-15 patients being reviewed daily as outpatients and 1-3 renal transplants done on a monthly basis. About 110 patients are on maintenance haemodialysis every month with 1-2 new patients joining haemodialysis every week. The renal unit has 35 functional renal machines that are serviced and calibrated regularly. On average, 25 patients are on haemodialysis at any given time between 8 AM to 11 PM daily.

The renal lab is attached to the renal unit and works 24 hours with various machines operated by competent technologists. It contains the Human Analyser Cellydyne 3200 and the Mindray Clinical Chemistry Analyser amongst other machines that are capable of assessing haemoglobin levels, UECS (Urea, Electrolytes and Creatinine), Hepatitis markers, Random Blood Sugar (RBS) and other pre and post dialysis tests required at the renal unit. The renal lab at KNH has the capability to handle the volumes presented from the renal unit with a quick turnaround time. Its machines are serviced regularly.

Study population: All adults aged above 18 years old at Kenyatta National Hospital Renal Unit on maintenance haemodialysis.

Case definition

Maintenance haemodialysis: Was defined as haemodialysis for a minimum of 3 months.

IDH: Was defined as an increase in systolic blood pressure by at least 10mmhg from pre to posthaemodialysis readings in a minimum of four out of six consecutive dialysis sessions.

Fluid overload: Any value greater than 1.1L as measured by bio impedance was defined as fluid overload (18,19).

-< 1.1L (<7% OH) - Normal hydration status.
-1.1-2.5L (7% - 15% OH)-Mild fluid overload.
->2.5L (15 % OH) - Gross fluid overload.

Sodium gradient: The difference between the dialysate sodium concentration and the pre dialysis serum sodium concentration (20).

Potassium gradient: The difference between the dialysate potassium concentration and the predialysis serum potassium concentration.

Inclusion criteria

(i) Haemodialysis for a minimum of 3 months.
(ii) Age above 18 years.
(iii) Informed consent.
Exclusion criteria

(i) Those who changed their mode of dialysis during the study period.
(ii) Patients with contraindications to bio impedance e.g. pacemakers, pregnancy, amputees and those with metal implants.

Sample size estimation

About 110 kidney patients were on maintenance haemodialysis every month at Kenyatta National Hospital Renal Unit. The intended population of study was finite (less than 10,000), therefore, The Daniel, 1999 formula that is used to estimate sample size in a finite population was used, based on the Senegal and South African study where prevalence of IDH was 22% and 28%, we used a prevalence of 28% (70).

\[ n' = \frac{NZ^2P(1-P)}{d^2(N-1) + Z^2 P(1-P)} \]

Where:

- \( n' \) is the sample size with finite population correction.
- \( N \) is the population size.
- \( Z \) is the statistic for level of confidence.
- \( P \) is the expected proportion (in proportion of one).
- \( d \) is the desired precision e.g. within +/-5%

\[ 110(1.96x1.96)0.28(1-0.28)/ 0.05x0.05 (110-1) + (1.96x1.96)0.28(1-0.28) \]

Sample size = 86

Consecutive sampling was used to recruit study participants on each day until the sample size was attained.

Recruitment procedure

All patients visiting the renal unit were screened at the renal unit admission desk by the principal investigator at admission. The study, its objectives, involved procedures to be done on the participants including what was to be done with the results was explained verbally in English and Kiswahili and later a written format given to the patients. A written consent form was given to those willing to provide a written consent. All those who met the inclusion criteria and were willing to provide a written consent were recruited into the study.

Clinical and laboratory methods

Clinical methods: The principal investigator with the help of the research assistant (a trained clinical officer), recruited participants, took anthropometric measurements and recorded data. The principal investigator did direct interviews and examination of participants. Socio-demographic data and medical history was obtained from the patient's medical records at Kenyatta National Hospital Renal Unit. Patients' weight was obtained using a digital weighing scale (secar n) in kilograms at initiation of haemodialysis, while height in meters was measured with a standard stadiometer. Body mass index was calculated using the formula kg/m² (Kilograms/Meter Squared) where kg was a person's weight in kilograms and m² was their height in meters squared. EPO dose / kilograms was obtained from all participants and documented. Blood pressure on each participant was obtained before and after dialysis. This was done for 4-6 consecutive dialysis sessions on each participant.

Blood pressure in patients pre dialysis was done in patients seated quietly for at least 5 minutes with feet on the floor and arms at the heart level, this was done 5 minutes before dialysis (two readings) and later repeated at the end of dialysis (two readings) after restoring the extracorporeal blood circuit. BP machines of the Omron * /Spengler * were used (21).

All the involved health care staff were trained on how to take blood pressure and use of appropriate cuffs. Caffeine, exercise and smoking were avoided at least 30 minutes prior to BP measurement.

Bio impedance measurements were done on all those eligible to participate in the study at the beginning of the study with strict adherence to standard operating procedures to ensure we get accurate results. The electrodes were placed on a patient lying supine for at least 10 minutes. A software (BC4) provided by the manufacturer was used to interpret the resistance and reactance values from the bioimpedance machine (Quantum 2 bio impedance analyser manufactured by RJL systems) that gave us fluid volume in both intra and extracellular compartments. Any values >1.1 (greater than 7% OH) was interpreted as FO (Fluid Overload) (1.1-2.5L-mild FO (7 -15%OH)>2.5L (15%OH) – Gross FO).

Laboratory methods: Each patient had 5mls of venous blood drawn aseptically from the antecubital fossa, 3mls was put into the red vacutainer for serum electrolytes (sodium and potassium) analysis and 2mls into the purple vacutainer for a haemoglobin level. All samples were stored at the renal lab at -20 degrees Celsius until the time of analysis. Haemograms were done at the renal lab using the Human Analyser Cellodyne 3200 and haemoglobin levels recorded for the purpose of the study. Serum electrolytes were done at the renal lab using an automated machine (Mindray Clinical Chemistry Analyser). Serum sodium and potassium levels were recorded in a pro-forma sheet that were later analysed. All excess blood samples of blood were discarded into the red bin and later taken to a central place in KNH for incineration. All the lab tests were done at the beginning of the study with competent technologists at KNH. An electrolyte gradient was then determined by getting the
difference between dialysate sodium and potassium and serum sodium and potassium levels.

Patients variables

(i) **Age**: Difference between year of birth and current year documented in years.
(ii) **Gender**: This was taken as self-identity of participants as either male or female.
(iii) **Duration of Chronic Kidney Disease (CKD)**: Difference between current year (2019) and year of diagnosis of chronic kidney disease.
(iv) **Duration of dialysis**: Difference between current year and year when dialysis was initiated.
(v) **Blood pressure**: JNC 7 was used to interpret and group various blood pressure findings (22).
(vi) **Pulse pressure**: Average systolic minus diastolic blood pressure readings.
(vii) **Treatment**: All the medications for various conditions the patient was being treated for was recorded, in addition, the number of dialysis sessions per week was also recorded.
(viii) **Body Mass Index**: Was calculated using the aforementioned formula and classified as normal weight, underweight or overweight.

Data management and analysis

All data collected was recorded on a pro-forma sheet and stored by the Principal Investigator until they were analysed. All the data gathered or used in the study; primary, secondary; hard copies were kept confidential and stored by the Principal Investigator in a secure lockable cabinet only accessible to the Principal Investigator. Electronic data was kept in folders accessible by passwords only known to the principal investigator.

The patients’ medical records at the renal unit that were used to obtain socio demographic and medical data was not tampered with. They were kept confidential and not shared outside the study. They were all returned to the records department at the renal unit for proper storage and future follow up of the patient. All data was entered and analysed by use of SPSS (Version 21.0, Chicago Illinois). The prevalence of IDH was calculated as a percentage of patients who met the definition criteria. Categorical data was analysed and displayed as proportion and frequencies while Continuous data was analysed and summarized as means and standard deviation.

Chi square test was used to test the association between IDH and selected characteristics and associated factors in those patients with intradialytic hypertension at KNH Renal Unit participating in the study. P-value and 95% Confidence Interval were calculated where necessary. A P-value <0.05 was considered to be statistically significant.

Results

The study was carried out between 25th March 2019 and 14th April 2019 at the KNH renal unit. A total of 110 patients were screened for the study, 2 (1.8%) had exclusion criteria while 22 (20%) others did not complete the study.

Eighty six patients (78 participated in the study to completion). At the beginning of the study, blood samples were drawn for serum electrolytes and haemoglobin analysis, fluid status was assessed by

Figure 1: Flowchart of patient’ enrollment

13
bioimpedance and later on their blood pressures were monitored for 6 consecutive dialysis sessions (Figure 1). **Patients’ baseline characteristics:** A total of 86 patients on regular haemodialysis (twice a week haemodialysis) participated in the study, there were 52 (60.5%) males and 34 (39.5%) females. The male to female ratio was 1.5:1. The mean age of participants was 47.3±13.5 years. Majority (66.3%) of study participants were hypertensive with 62.6% of them having a systolic/diastolic hypertension pattern. Our patients had a higher mean post dialysis MAP and SBP compared to pre dialysis readings (109.1±16.8 vs 103.6±20.6 and 151.9±25.6 vs 143.5±21.9 respectively). Other baseline characteristics (marital-status, educational level, diabetes, cigarette and alcohol use) of the study population are as demonstrated below (Tables 1A and B, Figures 2, 3, 4 and 5).

**Table 1A:** Patients’ sociodemographic characteristics (N=86)

<table>
<thead>
<tr>
<th>All patients</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age in years</td>
<td>47.3±13.5</td>
</tr>
<tr>
<td>Alcohol use in the last 1 year</td>
<td>23 (26.7%)</td>
</tr>
<tr>
<td>Cigarette smoking in the last 1 year</td>
<td>3 (3.5%)</td>
</tr>
<tr>
<td>Alcohol/Cigarette use in the last 1 year</td>
<td>7 (8.1%)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>5 (5.8%)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>57 (66.3%)</td>
</tr>
</tbody>
</table>

**Figure 2:** Gender

- Male
- Female

**Figure 3:** Marital status

- Single
- Separated / Divorced
- Married
- Widowed

**Figure 4:** Education level

- College
- Less than primary
- Secondary
- Primary

**Table 1B:** Patients’ clinical characteristics

<table>
<thead>
<tr>
<th>All patients</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre dialysis MAP</td>
<td>103.6±20.6</td>
</tr>
<tr>
<td>Post dialysis MAP</td>
<td>109.1±16.8</td>
</tr>
<tr>
<td>Mean Pre dialysis SBP</td>
<td>143.5±21.9</td>
</tr>
<tr>
<td>Mean Post dialysis SBP</td>
<td>151.9±25.6</td>
</tr>
</tbody>
</table>
**IDH prevalence:** All the 86 patients who participated in the study had their blood pressures recorded for 6 consecutive dialysis sessions. A total of 44 patients out of the 86 patients were found to have IDH resulting in a prevalence of 51.2%.

**Associated factors:** There was not much difference in age between those with and without IDH. (IDH - 49.2±13.2 years in comparison to No IDH-45.4±13 years). Males constituted most of those with IDH (28 (63.6%)-Males versus 16 (36.4%) - females). We did not have a significant difference in BMI between the two groups. The mean average BMI for all patients was 22.2±3.6 (IDH -22.6±3.9 in comparison to Non IDH- 21.8±3.3). The duration of dialysis was equally distributed between those with and without IDH. Most (65.1%) participants had dialyzed for less than one year. A total of 29 (33.7%) had dialyzed for less than six months [IDH-16 (36.4%) versus No IDH-13 (31.0%)] while 27 (31.4%) had dialyzed between six months to one year. Amongst this cohort 17 (38.6%) had IDH in comparison to 10 (23.8%) with no IDH. The above is demonstrated in Table 2A.

**Table 2A: Comparison of socio demographic parameters**

<table>
<thead>
<tr>
<th></th>
<th>IDH</th>
<th>No IDH</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall mean age (years)</td>
<td>49.2±13.2</td>
<td>45.4±13.6</td>
<td>0.198</td>
</tr>
<tr>
<td>Male</td>
<td>53.6±12.8</td>
<td>50.8±13.2</td>
<td>0.434</td>
</tr>
<tr>
<td>Female</td>
<td>41.3±10.0</td>
<td>38.2±10.8</td>
<td>0.395</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>28 (63.6)</td>
<td>24 (57.1)</td>
<td>0.538</td>
</tr>
<tr>
<td>Female</td>
<td>16 (36.4)</td>
<td>18 (42.9)</td>
<td>Ref</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall BMI</td>
<td>22.6±3.9</td>
<td>21.8±3.3</td>
<td>0.284</td>
</tr>
<tr>
<td>Underweight (&lt;18.5)</td>
<td>7 (15.9)</td>
<td>6 (14.3)</td>
<td>0.498</td>
</tr>
<tr>
<td>Normal (18.5-24.9)</td>
<td>23 (52.3)</td>
<td>30 (71.4)</td>
<td>Ref</td>
</tr>
<tr>
<td>Overweight (25.0-29.9)</td>
<td>11 (25)</td>
<td>5 (11.9)</td>
<td>0.075</td>
</tr>
<tr>
<td>Obese (&gt;=30.0)</td>
<td>3 (6.8)</td>
<td>1 (2.4)</td>
<td>0.322</td>
</tr>
<tr>
<td>Duration of dialysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;6 months</td>
<td>16 (36.4)</td>
<td>13 (31.0)</td>
<td>Ref</td>
</tr>
<tr>
<td>6 months - 1 year</td>
<td>17 (38.6)</td>
<td>10 (23.8)</td>
<td>0.554</td>
</tr>
<tr>
<td>1 - 2 years</td>
<td>4 (9.1)</td>
<td>10 (23.8)</td>
<td>0.101</td>
</tr>
<tr>
<td>&gt; 2 years</td>
<td>7 (15.9)</td>
<td>9 (21.4)</td>
<td>0.463</td>
</tr>
</tbody>
</table>
Both sets of groups had a similar profile in terms of haemoglobin level, fluid status and serum electrolyte as demonstrated in Table 2B.

All participants had some degree of fluid overload. The average pre-dialytic relative over hydration was 14.8% ±7.3 (mild fluid overload). IDH patients had a relative over hydration of 15.6%±7.7 (Gross fluid overload) in comparison to 13.9%±6.8 (mild overload) in those without IDH. The mean pulse pressure post dialysis was 63.7±17.8mmHg, IDH participants had a higher post dialysis pulse pressure (IDH - 72.2±16.6mmHg versus Non IDH 54.7±14.3mmHg, P-value < 0.001). The same trend was seen with pre dialysis pulse pressure.

### Table 2B: Comparison of clinical parameters

<table>
<thead>
<tr>
<th>Fluid status</th>
<th>All patients</th>
<th>IDH</th>
<th>No IDH</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-dialysis OH (%) Mean</td>
<td>14.8±7.3</td>
<td>15.6±7.7</td>
<td>13.9±6.8</td>
<td>0.273</td>
</tr>
<tr>
<td>&lt;7%</td>
<td>13 (15.1)</td>
<td>5 (11.4)</td>
<td>8 (19.0)</td>
<td>Ref</td>
</tr>
<tr>
<td>7-15%</td>
<td>28 (32.8)</td>
<td>15 (34.1)</td>
<td>13 (31.0)</td>
<td>0.368</td>
</tr>
<tr>
<td>&gt;15%</td>
<td>45 (52.3)</td>
<td>24 (54.5)</td>
<td>21 (50.0)</td>
<td>0.345</td>
</tr>
<tr>
<td>Pre-dialysis ECW (%)</td>
<td>16.9±4.5</td>
<td>18.4±4.7</td>
<td>17.4±4.3</td>
<td>0.270</td>
</tr>
<tr>
<td>Serum electrolytes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum sodium pre-dialysis</td>
<td>135.6±6.7</td>
<td>134.6±7.2</td>
<td>136.8±6.0</td>
<td>0.128</td>
</tr>
<tr>
<td>Sodium gradient</td>
<td>4.4±6.7</td>
<td>5.4±7.2</td>
<td>3.4±6.2</td>
<td>0.169</td>
</tr>
<tr>
<td>Serum potassium pre-dialysis</td>
<td>4.7±0.9</td>
<td>4.8±0.9</td>
<td>4.7±0.9</td>
<td>0.614</td>
</tr>
<tr>
<td>Potassium gradient</td>
<td>-2.9±1.1</td>
<td>-2.8±0.9</td>
<td>-2.6±1.3</td>
<td>0.334</td>
</tr>
<tr>
<td>Haemoglobin</td>
<td>8.6±1.9</td>
<td>8.8±2.1</td>
<td>8.4±1.9</td>
<td>0.250</td>
</tr>
<tr>
<td>Pulse pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PP post dialysis</td>
<td>63.7±17.8</td>
<td>72.2±16.6</td>
<td>54.7±14.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PP pre dialysis</td>
<td>57.8±17.9</td>
<td>64.2±17.2</td>
<td>50.8±16.0</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Sixty (69.8%) of participants were on antihypertensive medications. Slightly more patients with IDH were on antihypertensive drugs (IDH-58.3% versus No IDH-41.7%). The average number of drug molecules used per patient was 1.88±0.8. CCBs, [56 (93.3%)] were the most commonly prescribed medications in those with ESRD at KNH renal unit (Table 3).

Over the last 3 months only 4 patients in the study were on regular EPO with x 2 weekly infusion of 2000IU. None had IDH. There was inadequate data to analyse this factor as a contributing factor to IDH.

### Table 3: Types of anti-hypertensive medication

<table>
<thead>
<tr>
<th>BP Meds</th>
<th>All patients</th>
<th>IDH</th>
<th>No IDH</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total No. of patients on medication</td>
<td>60 (100%)</td>
<td>35 (58.3%)</td>
<td>25 (41.7%)</td>
<td></td>
</tr>
<tr>
<td>ACEI/ARB</td>
<td>1 (1.7%)</td>
<td>0</td>
<td>1 (1.7%)</td>
<td>0.400</td>
</tr>
<tr>
<td>α-blocker</td>
<td>3 (5.0%)</td>
<td>2 (3.3%)</td>
<td>1 (1.7%)</td>
<td>1.000</td>
</tr>
<tr>
<td>β-blocker</td>
<td>30 (50.0%)</td>
<td>21 (35.0%)</td>
<td>9 (15.0%)</td>
<td>0.197</td>
</tr>
<tr>
<td>CCB</td>
<td>56 (93.3%)</td>
<td>33 (55.0%)</td>
<td>23 (38.3%)</td>
<td>0.823</td>
</tr>
<tr>
<td>Diuretic</td>
<td>2 (3.3%)</td>
<td>2 (3.3%)</td>
<td>0</td>
<td>0.516</td>
</tr>
<tr>
<td>Hydralazine</td>
<td>28 (46.7%)</td>
<td>14 (23.3%)</td>
<td>14 (23.3%)</td>
<td>0.217</td>
</tr>
<tr>
<td>Mean No. of drugs</td>
<td>1.88±0.8</td>
<td>1.89±0.8</td>
<td>1.85±0.8</td>
<td></td>
</tr>
</tbody>
</table>
Discussion

The prevalence of IDH is 51.2%. This is way higher than in most studies done elsewhere where it averages 15-30%. A number of factors might have contributed to this. Moustapha et al (4) found a prevalence of 22.6% in a study done to determine the prevalence and associated factors in haemodialysis patients in Senegal in 2017, their study population had a number of significant differences to the one in Kenya; Most of their patients underwent three times haemodialysis sessions per week compared with twice per week at KNH renal unit, 40% of their patients were on ACEI/ ARBS compared to 1% in our setup (4). Similar findings were found in South Africa in 2014 by Chothia et al. (5) who had a prevalence of 28.4% in a study done on IDH during chronic haemodialysis and subclinical fluid overload assessed by BIS, In South Africa, 33% of patients were on ACEI compared to 1% in our setup, 48% were on diuretics compared to 2% in our set up. Most patients underwent three sessions of dialysis per week compared to twice at KNH renal unit. The study population in South Africa had better fluid status pre dialysis compared to our study population, ECW; 3.5% vs 18.4% amongst the IDH patients (5).

In Indonesia, two studies done in 2016 and 2019 found a prevalence of 53.1% and 41.4% respectively. In 2016 Adiwanata et al. (24) did a study on prevalence and risk factors analysis of IDH among chronic haemodialysis patients at Dr Kanujoso Djatibowo Public Hospital while in 2019, Andryan et al. (23) did a study on characteristics of dialysis patients with IDH at the haemodialysis unit at Sumdong Regional Public Hospital. The studies in Indonesia had similar characteristics to ours with patients undergoing two sessions of haemodialysis every week and most patients being on calcium channel blockers for blood pressure control.

Most of the study participants were on CCBs (93% of those on medications). This may partly explain the high prevalence in our study. ACEI, ARBS and BB are thought to decrease IDH. ACEI and ARBS reduce RAAS activity while BB especially carvedilol reduces endothelial dysfunction (25).

In our study, one of the factors that was found to be associated with increase in SBP during dialysis was high post dialysis SBP. Increase in post dialysis SBP is associated with extracellular over hydration and less change in weight post dialysis. This could partly explain the high over hydration status in our cohort of patients. This can be addressed by reviewing and individualizing individual patient target weight and dialysis requirements. These are candidates for increased dialysis duration or frequency (26).

High PP was a predictor of IDH. Several studies have shown that High PP is an independent cardiovascular risk factor of mean arterial pressure. It predicts the probability of getting MI and CVA. Unlike in the Italian study where only pre dialytic PP was more significant, both high pre and post dialytic PP have been found to be statistically significant in our study. More studies are needed on both pre and post dialytic pulse pressures and their impact on mortality (27).

Some studies have reported that IDH is more common in the elderly (>65 years) and that those patients are mostly on multiple drugs. We found no association between those two factors and IDH in our study where most patients were on two drugs and the average age of patients was 47.3±13.5 years.

No correlation was established between the serum electrolyte and gradient with IDH in our study. Higher BMI more than 30 has been found to decrease the incidence of IDH by unknown mechanism (28–30), this was not established in our study. We did not manage to find enough data to assess the effect on EPO on IDH.

Conclusion

IDH is often neglected despite it being recognized for many years, our study clearly shows that it is common in our cohort of haemodialysis patients with most of them having gross fluid overload. Its management is essential and should possibly incorporate adequate management of fluid status in these patients.

Recommendations

(i) Increase the frequency /duration of dialysis in all our patients to attain better fluid status control and decrease or better manage IDH.

(ii) Individualize each patient’s dialysis needs and get ideal target weight and strive to achieve it with adequate dialysis and medications.

(iii) Incorporate ACEI and ARBS together with beta blockers especially carvedilol in our blood pressure control in ESRD patients on maintenance haemodialysis.

(iv) Widespread use of bio impedance in assessing volume control in haemodialysis units.

Limitations

Eighty six is a small number, a larger cohort may be needed to establish a statistically significant result that is more representative regarding fluid overload and IDH. Inability to compare frequency of dialysis and impact on IDH as all patients were on twice weekly haemodialysis sessions.
References


