IS THERE ANY CORRELATION BETWEEN INTRADIALYTIC COMPLICATIONS AND INTERDIALYTIC WEIGHT GAIN (IDWG)?

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ABSTRACT

Background: Intradialytic complications are commonly experienced in hemodialysis patients. Haemodialysis patients usually gain weight between two dialysis times (interdialytic weight gain = IDWG). Patients who experience an increase in IDWG are associated with the incidence of intradialytic complications, such as hypotension, muscle cramps, hypertension, chest pain, headache, fever, nausea and vomiting.

Objectives: To analyze the correlation between intradialytic complications and IDWG.

Methods: This study used an observational analysis method with a cross-sectional design. Sample were recruited by using simple random sampling as and there were 56 samples on inclusion criteria. Data were analyzed using Pearson product moment with significance level \( \alpha \leq 0.05 \). Research ethics was obtained from Margono Soekarjo Hospital.

Results: The results showed that highest IDWG is 6.58% and the lowest is 0.62%. Complications most experienced intradialytic hypertension (85.7%), followed by muscle cramps (55.4%), nausea (51.8%), headache (46.4%), chest pain (12.5%), fever (8.9%) and hypotension (5.4%). There was correlation between interdialytic weight gain (IDWG) and intradialysis complications \((p=0.00 \text{ and } r=0.443)\).

Conclusion: It concluded that there was correlation between IDWG and intradialytic complications in patients undergoing a hemodialysis treatment at RSUD Prof. Dr Margono Soekarjo Purwokerto.

Keywords: IDWG, Intradialytic complications, hemodialysis

INTRODUCTION

Undergoing hemodialysis brings various consequences for patients with renal failure (CKD) who depend on hemodialysis machines, strict fluid and food regulation intake. One of the serious complications is intradialytic complication. It is complications that occur when the patients receiving hemodialysis therapy. Intradialytic complications could threaten patients’ life.[1] The complications are divided into three types; patient-related complication, technical complication and vascular-related access complication. The prevalence of intradialytic complications among patients undergoing hemodialysis ranging from 20% to 63%.[2],[3],[4],[5],[6] Some research in Indonesia even reported that nearly 70% patients had intradialytic complications.[7] Those complications are headache (40%), hypotension (26%), muscle cramps (18%), arrhythmias (12%), nausea and vomiting (10%), shortness of breath (10%) and fever and chills (2%). Other studies showed most common complication hemodialysis are hypotension (26.8%), headache (25.1%) and hypotension (24.7%) complications of vascular access (4.4%) and technical complications (3.1%).[1]. Predictors of intradialytic complications are reduction in cardiac output, idiopathic [8], factors, fatigue muscles, lack of stretching and warming up, impaired blood circulation to muscle, and duration of hemodialysis process. Furthermore, the level of urea in the body and the amount of ultrafiltration [9],[10], and age and diet during hemodialysis also contribute as intradialytic predictors.[11] Because of the failure in excretion function, CKD patients have difficulty managing fluid and food intake. As a result, the patients gain more weight between two hemodialysis times (interdialysis weight gain = IDWG). The increase of IDWG is associated with high risk of heart disease, death and hospitalization.[12] The increase of IDWG percentage is also correlated with the rising of pre-dialysis blood pressure complications and changes in blood pressure during hemodialysis. Factors related to IDWG are age, height and weight, diuresis, and sodium post dialysis.[13] IDWG were measured based on the patient’s dry weight and...
also from the patient’s clinical condition. The normal value of IDWG based on KDOQI (2015) should be lower than 4.0% - 4.5% of dry weight. High IDWG is associated with a higher risk of morbidity and mortality due to cardiovascular problems, such as ventricular hypertrophy and major adverse cardiac and cerebrovascular events. IDWG values above 4.8% was caused by various comorbidities, congestive heart failure, hypertension, hypotension, left heart failure, ascites and pleural effusion. About 8,661 hemodialysis patients reported that the mortality of those with Albumin value ≥3.8 g / dL and IDWG above 6% increased. Hemodialysis unit of Prof. Dr. MargonoSoekarjo (RSMS) hospital has around 30 HD machines and has provided hemodialysis services to over 14,500 HD actions per year. Every month the hospital serves around 200 patients who need hemodialysis both from In Patient Department (IPD) and Out Patient Department (OPD). The results of the preliminary study in February 2018 showed that the procedure for hemodialysis from January to December was around 13,606 HD actions. Previous research at the hospital focused on fatigue problems, quality of life, depression anxiety and adequate hemodialysis. Various theoretical findings and previous research that imply there is a link between intradialytic complications and IDWG require stronger scientific evidence. The purpose of this study was to analyze whether there was a relationship between the incidence of intradialytic complications and IDWG values.

Methods

This study was an observational analytic descriptive study with a cross sectional approach. 56 samples were recruited with a simple random sampling technique. The study was conducted between March and April 2018 in RS Margono Soekarjo, Indonesia Hemodialysis Unit. The ethical clearance was obtained from the hospital ethics commission (No.420 / 025279 / III / 2018). The research data was obtained through observational sheet activities from the initial preparation before, during and after hemodialysis. Researchers and the team took measurements of the patient's vital signs and clinical conditions including body weight. After the patient is connected to the hemodialysis machine, researchers begin to observe the incidence of intradialysis complications from the first, second, third and fourth hours by measuring blood pressure every hour and asking for patient complaints and observing events during hemodialysis. Measurements of vital signs and weight were carried out post hemodialysis 10 minutes after hemodialysis ended including weighting and IDWG calculation. The data were then analyzed using Pearson Product Moment correlation test.

Results

There was an even number of male and female respondents among 56 patients who were enrolled in this study and most of them had arterovenous shunt access (94.6%). Approximately two thirds of the total respondents (64%) had increased IDWG of less than 4% (table 1).

Table 1. Patients characteristic: distributions of gender, HD access, IDWG addition (n=56)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency (f)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>28</td>
<td>50</td>
</tr>
<tr>
<td>female</td>
<td>28</td>
<td>50</td>
</tr>
<tr>
<td>HD access</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AV shunt</td>
<td>53</td>
<td>94.6</td>
</tr>
<tr>
<td>Femoral</td>
<td>3</td>
<td>5.4</td>
</tr>
<tr>
<td>IDWG addition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 4%</td>
<td>36</td>
<td>64</td>
</tr>
<tr>
<td>4-6%</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>&gt; 6%</td>
<td>6</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 2 shows that the average age of the respondents was 48.4 years old (±SD = 10.7), the length of hemodialysis was 28.6 (±SD = 21) months, with Qb 303.12 (42.47). The addition of IDWG 3.76% (1.42) and intradialytic complications experienced 5 (1.93 ) with maximum 9 types of intradialytic complications.

Table 2. Patient characteristic: distributions of gender, increase IDWG and number of intradialytic complication (n=56)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>Min – Max</th>
</tr>
</thead>
</table>

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During 4 hours of hemodialysis therapy, all respondents in this study reported that they experienced one or more intradialytic complications. The most common complications were intradialytic hypertension (85.7%), followed by muscle cramps (55.4%), nausea (51.8%), headache (46.4%), chest pain (12.5%), fever (8.9%) and hypotension (5.4%) (Table 3).

### Table 3. The incidence of intradialytic complications (n=56)

<table>
<thead>
<tr>
<th>Intradialysis complications</th>
<th>Frequency (f)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>48</td>
<td>85.7</td>
</tr>
<tr>
<td>Headache</td>
<td>26</td>
<td>46.4</td>
</tr>
<tr>
<td>Muscle cramp</td>
<td>31</td>
<td>55.4</td>
</tr>
<tr>
<td>Nausea</td>
<td>29</td>
<td>51.8</td>
</tr>
<tr>
<td>Chest pain</td>
<td>7</td>
<td>12.5</td>
</tr>
<tr>
<td>Hypotension</td>
<td>3</td>
<td>5.4</td>
</tr>
<tr>
<td>Fever</td>
<td>5</td>
<td>8.9</td>
</tr>
</tbody>
</table>

In contrast to the results of previous study among 740 hemodialysis patients, those who experienced intradialytic complications were only 480 patients (65%), respondents had more than 3 complications, 75 having 3 complications, 146 having 2 complications and 226 having only 1 intradialytic complication. In this study all respondents who underwent hemodialysis experienced an average of 5 intradialysis complications, a minimum of 1 and maximum of 9 events. Respondents who experienced intradialysis complications 1 incident, occurred at the 4th hour of dialysis and the type was muscle cramps. The results of this study strengthen other previous studies which reported that most common complications during hemodialysis were headache (25.1%) and hypertension (24.7%).[1] The severity and frequency of intradialytic complications depend on the underlying conditions of the patients such as coronary artery disease, diabetes mellitus, hypertension, congestive heart failure and most importantly the level of compliance of patients with complex treatment. Intradialytic complications could be managed successfully without the need for termination of the dialysis procedure, if we have special attention for the diagnosis and management of intradialytic complications of HD.[3] An increase in the frequency and severity of hypotension, muscle cramps, headache, and disequilibrium dialysis syndrome can be due to faster and more aggressive use of UF with shorter dialysis times.[1] In regards, the incidence of muscle cramps is not yet known, but cramps are prone to occur more often when UFR is high and the use of Na dialysate is low.[19] Occurrence of nausea and vomiting are also common among the patients. Vomiting is caused by a rapid drop in blood pressure and urea.[20] Eating in two sessions of hemodialysis causes a decrease in systolic eating less than an hour before therapy or during therapy will cause nausea. [21] Body position during hemodialysis also affects the occurrence of nausea. Supine position causes more nausea and vomiting compared to half-sitting.[22] The results of this study support previous studies [23] which showed a significant relationship between hypotension and age, sex and interdialytic weight. Moreover there was also a strong correlation between shivering, gender and interdialytic weight, vomiting and sex, headaches with gender and age. The incidence of complications during hemodialysis can be affected by socio-demographic and clinical factors. Headaches during hemodialysis are statistically related to gender and age [3], also due to stress faced by patients undergoing dialysis and is associated with a decrease in magnesium levels and an increase in sodium level in the pre and post dialysis periods.[23] Hypertension during hemodialysis in this study was very high. This result was in accordance with IRR report in 2017 that intradialytic hypertension was still the most common complication which experience by 36% of the patients. This can be due to multifactors, for example excessive fluid volume, sympathetic nerves activity, activation of the renin-angiotensin system, endothelial cell dysfunction, dialysis technique.[24] However, recent studies confirm that intradialytic hypertension is associated with endothelial cell dysfunction.[25] IDWG value is above 4.8% of dry body hemodialysis patients associated with various poes of congestive heart failure, hypertension, hypotension, left heart failure, ascites.
and pleural effusion.[18] Based on the statistical analysis, it is known that there is a correlation between the incidence of Intradialysis Complications and the IDWG value of patients undergoing hemodialysis (p value 0.001 <0.05) with a fair strong relationship (r = 0.443). Based on observations made by the researchers, the high number of occurrence of intradialytic hypertension among patients was because most patients had hypertension before undergoing hemodialysis. All patients ate and drank during hemodialysis session, especially in the 2nd and 4th hour of the session. They also usually laid in supine position or semi-fowler position when they underwent hemodialysis session. The percentage of IDWG among patients was influenced by gender, dialysis time, age and nutritional status. Furthermore, IDWG was strongly related to blood pressure in hemodialysis patients, when the percentage of IDWG increased, their blood pressure decreased.[26] IDWG the higher percentage of body weight (% IDWG) was associated with younger age, greater height and weight, absence of diuresis, and decreased plasma sodium postdialysis. Diastolic predialysis, intradialysis, and postdialysis blood pressure were significantly higher in patients with increased IDWG.[14] IDWG also significantly related to physical and psychological quality of life, albumin, and total protein potassium value [27] and mortality.[16] Based on the results of this study, the average of IDWG is 3.76% and around 20 respondents have IDWG above 4%, while the KDOQI standard is lower than 4.0% -4.5% of dry weight. This supports the relationship of an increase in %IDWG with the age of respondents, most of whom are aged 48.5 years and above and have an impact on the incidence of intradialytic complications that are experienced by all respondents. IDWG correlates with the increase of blood pressure during dialysis, so most complications that occur are intradialysis hypertension, headache, muscle cramps and nausea. The use of antihypertensive drugs and laboratory values examination such as albumin, Hb, potassium, and natrium, were not observed in this study. Those were considered as the limitation of the study. Therefore, further research related to dialysis complication should take these variables into account. Furthermore, it is necessary to conduct research related to IDWG management involving the factors influencing IDWG.

Conclusions
It concluded that there was correlation between IDWG and intradialytic complications in patients undergoing hemodialysis treatment, greater IDWG is associated with the increasing number of intradialysis complications occurrence.

Conflict of Interest
There are no conflicts of interestregarding the publication of this article.

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Ethical Clearance
The ethical clearance of the research was obtained from the ethics department of Prof Dr. Margono Soekardjo Purwokerto Hospital No.420/025279/III/2018

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