Correlation Between Intradialytic Hypotension in Patients Undergoing Routine Hemodialysis and Use of Acetate Compared to Bicarbonate Dialysate

M Thaha, M Yogiantoro, Soewanto, Pranawa

ABSTRACT

Aim: to determine the incidence of intradialytic hypotension (IDH) during hemodialysis (HD) in end-stage renal disease (ESRD) patients using acetate dialysate compared to those using bicarbonate dialysate.

Methods: this study was a double-blind cross-over randomized clinical trial. The effect of acetate and bicarbonate dialysate on blood pressure was analyzed in two consecutive HD sessions. The selected subjects were 41 stable ESRD patients scheduled for dialysis 2 times/week from the HD unit of Dr. Soetomo Hospital Surabaya, aged between 21-65 years old, with a hemoglobin level of ≥ 7 g/dL, serum albumin > 3mg/dL, and interdialytic weight gain <4 Kg, and an average Qb 150-250 ml/minute. The dialysate sodium level was 138 mEq/L. The study subjects were divided into two groups: 21 patients in the group who received Acetate on the first session and Bicarbonate on the next (AB) and 20 patients in the group receiving Bicarbonate first (BA). Comparison of IDH during use of each dialysate was analyzed by Chi-Square and McNemar Chi-Square test.

Results: no characteristic differences were found in both groups: HD duration (for AB) was 28.83 ± 13.89 vs. 34.95 ± 24.80 months (for BA) (p=0.333); Age (for AB) was 47.61 ± 9.49 vs. 47.75 ± 11.80 years (for BA) (p=0.969); Hemoglobin (Hb) level (for AB) 8.19 ± 0.84 vs. 7.94±0.41 mg/dL (for BA) (p=0.238); serum Albumin (for AB) was 3.79 ± 0.26 vs. 3.82±0.30 g/dL (for BA) (p=0.652). The number of patients with IDH during acetate dialysate was 23 (56.1%). On the contrary, the number of patients with IDH during bicarbonate dialysate was 1 (2.4%). Overall, there were 11 patients with Diabetic Kidney Disease (26.8%). Six out of them (54.5%) had IDH during acetate dialysate and only 1 patient (9.1%) had IDH during acetate and bicarbonate dialysate.

Conclusion: the incidence of IDH in hemodialysis using acetate is significantly greater than that when bicarbonate is used (p=0.000).

Key words: intradialytic hypotension, IDH, acetate dialysate, bicarbonate dialysate, dialysis, hemodialysis.

INTRODUCTION

Intradialytic hypotension (IDH) is one of the most common complications of hemodialysis (HD), and its incidence in the year 2000 varied from 15%-50% of sessions in the United States and around 23% at the Hemodialysis Unit of Dr. Soetomo Hospital, Surabaya, at which 80% were diabetes mellitus patients.4, 6, 16, 19, 20 This could increase the morbidity and mortality of end stage renal disease (ESRD) patients. The clinical manifestation of IDH varies from being asymptomatic to shock.

Hypotension in ESRD patients is divided into:20

• Hypotension episode (95%): during or the end of dialysis session, followed by nausea, vomiting, cramps and vagal symptoms.
• Chronic persistent hypotension (5%): ESRD patients with pre-dialysis systolic blood pressure of less than 110 mmHg.

Multiple factors cause IDH. Few studies reported that there was no significant difference in the incidence of IDH between groups using acetate and bicarbonate dialysate during dialysis if the sodium level is over 140 mEq/L.5, 20

Our study uses acetate dialysate with a sodium level of138 mEq/L. This study needs to be conducted because of the frequency and increase in patients with intradialytic hypotension, one of the cause being the frequent use of acetate dialysate.

Several studies reported that acetate dialysate more frequently caused IDH than bicarbonate.
Peripheral vasodilatation and decreased myocardial contractility were suspected to be the mechanisms of IDH caused by acetate.

The aim of this study is to determine the frequency of IDH during HD using acetate dialysate compared to HD using bicarbonate dialysate in ESRD patients.

**METHODS**

This study was a double-blind cross-over randomized clinical trial. The effect of acetate and bicarbonate dialysate on blood pressure was analyzed in 2 consecutive HD sessions. The selected subjects were 41 stable ESRD patients scheduled for dialysis 2 times/week from the HD unit of Dr. Soetomo Hospital Surabaya, they were between 21-65 years old, with a hemoglobin level of ≥ 7 g/dL, serum albumin ≥ 3mg/dL, and interdialytic weight gain < 4 Kg, and an average Qb 150-250 ml/minute. Patients with chronic persistent hypotension or those who refused to sign an informed consent form were excluded from the study. During the 1st session, 21 patients used acetate and bicarbonate, and then bicarbonate in the following session, while the other 20 patients used bicarbonate dialysate during the 1st session and then acetate dialysate in the 2nd session. Objective evaluation included blood pressure (BP), mean arterial pressure (MAP) measure 10 minutes before, hourly, and 30 minutes after HD. IDH is defined as reduction of MAP of ≥ 20% from the start of HD.

Comparison of IDH during the use of the two dialysates was analyzed by Chi-Square test and MeNemar Chi-Square using SPSS version 10. The results were presented in the textual, table and graphical form. The result is considered significant if the p value is less than 0.05.

**RESULTS**

Table 1 shows no difference in the characteristics of the groups. The incidence of IDH using acetate and bicarbonate dialysate is shown in Figure 1. Overall, there were 23 (56%) episodes of IDH during HD using acetate and only 1 (2%) episode of IDH during HD using bicarbonate dialysate. The frequency of IDH caused by acetate dialysate was higher than bicarbonate (p=0.000).

Table 1. Characteristics of The 41 Patients With ESRD

<table>
<thead>
<tr>
<th>DATA</th>
<th>AB GROUP (mean ± SD)</th>
<th>BA GROUP (mean ± SD)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>21</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>Male: Female</td>
<td>16:5</td>
<td>15:5</td>
<td>-</td>
</tr>
<tr>
<td>Duration of HD</td>
<td>28.83 ± 13.89 month</td>
<td>34.95 ± 24.80 month</td>
<td>0.333</td>
</tr>
<tr>
<td>Age</td>
<td>47.61 ± 9.49 years</td>
<td>47.75 ± 11.80 years</td>
<td>0.969</td>
</tr>
<tr>
<td>Hb</td>
<td>8.19 ± 0.84 mg/dL</td>
<td>7.94 ± 0.41 mg/dL</td>
<td>0.238</td>
</tr>
<tr>
<td>Albumin</td>
<td>3.79 ± 0.26 g/dL</td>
<td>3.82 ± 0.30 g/dL</td>
<td>0.742</td>
</tr>
<tr>
<td>Interdialytic Weight</td>
<td>2.38 ± 0.74 Kg</td>
<td>2.75 ± 0.75 Kg</td>
<td>0.652</td>
</tr>
</tbody>
</table>

Table 2. Interdialytic Weight in Patients with ESRD during HD using Acetate and Bicarbonate Dialysate

<table>
<thead>
<tr>
<th>ΔBB</th>
<th>ACETATE</th>
<th>BICARBONATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>3.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>1.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>2.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>3.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>2.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>3.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>1.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Figure 1. Comparison of IDH Frequency During HD Using Acetate and Bicarbonate Dialysate
There were 11 (27%) patients with diabetic kidney disease (DKD) (Figure 2) and 7 (64%) of them had IDH (Figure 3). Among those seven patients, 6 (six) (54%) had IDH during acetate dialysate and only 1 (one) (9%) had IDH during bicarbonate dialysate (Figure 4).

In our study, we found a mean decrease of MAP using acetate dialysate of 20.78 ± 6.46 mmHg, while the mean decrease of MAP using bicarbonate dialysate was 4.83 ± 6.41 mmHg. The difference between both groups was significant (p=0.000).

A study by Grafe et al reported an incidence of IDH using acetate dialysate of 24 among 27 subjects (89%) and 6 of 29 subjects (21%) while using bicarbonate dialysate. The sodium content in the dialysate used in the study was < 135 mEq/L.8

Similar results were reported by a number of researchers, where IDH frequency due to acetate dialysate was higher compared with bicarbonate dialysate.15,22,25,26

In our study, the frequency of IDH did not differ significantly from other studies. The IDH frequency caused by acetate dialysate was 23 among 41 subjects (56.1%) and 1 of 41 subjects while using bicarbonate (2.4%).

The incidence of IDH due to acetate was significantly higher than bicarbonate when the dialysate sodium level was less than 140 mEq/L. If the dialysate sodium level is equal to or exceeds 140, mEq/L there is no difference in IDH frequency between acetate and bicarbonate dialysate.4, 5, 10,24

Our study used an acetate dialysate substance with a dialysate sodium level of 138 mEq/L, and frequency IDH due to acetate dialysate was significantly higher (p=0.000).

Another proposed mechanism of IDH was due to depression of myocardial contractility, which was reported by several researchers.11,12,13

CONCLUSION

The frequency of IDH in groups AB as well as BA during hemodialysis with acetate dialysis is 23 (56.1%). The frequency of IDH in groups AB and BA during hemodialysis with bicarbonate dialysate is 1 subject (2.4%).

There was a significant difference in frequency of IDH between both groups using acetate and bicarbonate dialysates, with p=0.000.

REFERENCES