Influence Of Dialytic Modality On Renal Anaemia In CKD Patients

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Abstract: There have been documented data in the West that Continuous Ambulatory Peritoneal Dialysis patients are less anaemic and require less Erythropoietin than their haemodialysis counterparts. In this comparative study, 45 Haemodialysis (HD) patients and 56 Continuous ambulatory peritoneal dialysis (PD) patients followed up for a mean duration of 26 ± 4.6 months were evaluated for haematological parameters, iron indices and transfusion requirements. HD patients had a lower haemoglobin (Hb%, 8.9 ± 1.6 gm/dl) compared to PD patients (10.8 ± 0.8 gm/dl), despite higher erythropoietin requirement (116 ± 14.0 IU/kg/week in HD patients compared to 64 ± 21 IU/kg/week in PD patients) (p <0.05). IV iron requirement at the end of 12 months on therapy in the two groups to maintain similar transferrin saturation (TSAT) was high in HD patients (1860 ± 210 mg) compared to PD (1210 ± 380 mg). Mean ferritin levels were also significantly higher in HD patients (386 ± 96 ng/ml) compared to in PD patients (170 ± 58 ng/ml) (p <0.05). The number of patients needing one or more transfusions were significantly higher in HD population (11%) compared to PD population (2%) (p <0.05).

Key words: Comparative, Haemodialysis, Peritoneal Dialysis, Anaemia, Serum Ferritin, IV Iron, Transfusion.

Patients and Methods:
Chronic Kidney Disease (CKD) - stage V patients opting for either for PD or for HD as maintenance dialysis modality and willing to continue IV iron and erythropoietin formed the study group. The patients who got transferred from one modality to the other got excluded. In addition, those patients with documented GI blood loss, malignancies, uncontrolled hyperparathyroidism, active liver disease due to Hepatitis C (as defined by persistently elevated liver enzymes above the normal value for over 4 weeks with Hepatitis C antibody positivity), and those testing positive for HBsAg or HIV, Chronic Liver Disease, malnutrition (as defined by serum albumin <2.8 gm/dl) were also excluded. Those included had to be on four hours sessions of HD thrice weekly or at least 3 exchanges of PD per day.

A total of 56 patients on PD and 45 patients on HD qualified to enter into study. These patients were followed with a mean follow up period of 26 ± 4.6 months. The mean age of the population was 44 ± 11.2 years. Demographic characteristics in the two groups are shown in Table 1. PD patients were older and had a high number of diabetics compared to HD patients (Table 1).

Table 1. Demographic characteristics of patients

<table>
<thead>
<tr>
<th>Parameters</th>
<th>HD (n=45)</th>
<th>PD (n=56)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (yrs)</td>
<td>42 ± 12.2</td>
<td>48 ± 14.4</td>
</tr>
<tr>
<td>Sex (male:female)</td>
<td>4 : 1</td>
<td>5 : 1</td>
</tr>
<tr>
<td>Diabetics</td>
<td>30%</td>
<td>51%</td>
</tr>
<tr>
<td>Duration on dialysis (months)</td>
<td>26 ± 8.2</td>
<td>30 ± 7.2</td>
</tr>
<tr>
<td>Anti HCV +ve</td>
<td>n = 12</td>
<td>n = 2</td>
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<td>For antibodies (normal LFTs)</td>
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Results:
PD patients had a higher hemoglobin (10.8 ± 0.8 gm/dl) compared to HD group (8.9 ± 1.6 gm/dl). Mean ferritin levels in patients on HD were 356 ± 96ng/ml as compared to 170 ± 58ng/ml in PD patients (p<0.05). The mean serum albumin was 3.5 ± 0.3 gm/dl in HD and 3 ± 0.24 gm/dl in PD patients. The
weekly EPO requirement in HD population was $116 \pm 14$ IU/kg/week as compared to $64 \pm 21$ IU/kg/week in PD group ($p<0.05$). TSAT in the two groups was comparable (HD patients $23\pm3.6\%$ and PD patients $26\pm4.2\%$).

Total iron requirement at the end of one year of follow up was $1860 \pm 210$ mg in HD group as compared to $1210 \pm 380$ mg in the PD group. Blood transfusion requirement was much higher in the HD group (11% of patients) as compared to the PD group (2% of patients) ($p<0.05$) Table 2 and Figures 1 to 4 summarise the results.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>HD (n=45)</th>
<th>PD (n=56)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hb (gm/dl)</td>
<td>$8.9 \pm 1.6$</td>
<td>$10.8 \pm 0.8$</td>
</tr>
<tr>
<td>EPO requirement (IU/kg/week)</td>
<td>$116 \pm 14$</td>
<td>$64 \pm 21$</td>
</tr>
<tr>
<td>TSAT (%)</td>
<td>$23\pm3.6$</td>
<td>$26\pm4.2$</td>
</tr>
<tr>
<td>Serum Ferritin (ng/ml)</td>
<td>$356 \pm 96$</td>
<td>$170 \pm 58$</td>
</tr>
<tr>
<td>Serum Iron requirement at 1 year follow up (mg)</td>
<td>$1860 \pm 210$</td>
<td>$1210 \pm 380$</td>
</tr>
<tr>
<td>Blood transfusion (% patients needing one or more transfusions)</td>
<td>$11%$</td>
<td>$2%$</td>
</tr>
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</table>

**Discussion**

With the advent of Erythropoietin (EPO) and the availability of the various guidelines on anaemia management of CKD(1,2,3,4,5), there has been uniform standard of care of
treatment for dialysis patients either on Continuous ambulatory peritoneal dialysis or Haemodialysis. However, the degree of anaemia and requirement of EPO has been reported to be lower in PD patients as compared to HD patients with accepted standard management practices of renal anaemia (6).

In this study, we have compared the PD and HD patients followed up, who have been on regular EPO at recommended doses with iron supplementation (7). The findings in our study of lower haemoglobin, increased EPO requirement and increased transfusion requirements to maintain haematocrit in HD patients are consistent with that of House AA et al. (6). We have noted that ferritin level in our HD patients was significantly higher as compared to PD patients though TSAT was comparable between the two modalities. This reflects perhaps the underlying chronic inflammatory state common in HD population (8,9) as well as increased transfusion requirement in this group.

There is a need to maintain adequate Haemoglobin levels in both HD and PD patients as hospitalization and mortality rates in both diabetic and non-diabetic PD patients have been shown to be significantly correlate with decreasing haemoglobin level below 12gm/dl (10).

We also noted a lower mean serum albumin levels in PD group as compared to HD, despite being on good diet, as protein intake in PD patients does not match the western counter parts.

It is relevant to note the fact that high Ferritin levels need not be only related underlying inflammation and that iron supplementation may be given despite high Ferritin. Neither high Ferritin or low TSAT was predictor for clinical use in iron supplementation as demonstrated in DRIVE study (11). In a similar finding, none of the iron indices currently used (Reticulocyte hemoglobin content, Ferritin, transferrin saturation or soluble transferin receptor levels) were good predictors of response to anaemia when Ferritin levels were high significantly (12).

It is interesting to note that, despite being older (48 vs. 42 years) and more likely to be diabetic (51% vs. 30%), PD patients had higher hemoglobin levels with lower EPO and intravenous iron requirement. Had these baseline variables were to be similar, the prevalence of renal anemia in PD patients would have been even less. Thus, our data confirm that dialysis modality plays a significant role in the degree of renal anemia in CKD patients treated with renal replacement therapy.

The limitation of this study has been that we have measured inflammatory parameters such as C-reactive protein (CRP) in all patients. CRP is a strong predictor of resistance to erythropoietin in dialysis patients(13,14). However, we could not evaluate the correlation of CRP with ferritin level and EPO requirement.

In conclusion, this study suggests that the PD patients, in comparison to that of HD patients, do require lower doses of EPO to maintain haemoglobin with lower iron IV supplementation to reach recommended TSAT levels. They also have significantly lower ferritin levels as compared to HD patients and only very few patients on PD require blood transfusion to maintain the recommended haematocrit levels.

References:


