Profile of Anemia in Chronic Renal Failure Patients: Comparision Between Predialyzed and Dialyzed Patients at The Division of Nephrology, Department of Internal Medicine, Sanglah Hospital, Denpasar, Bali, Indonesia

Ketut Suega*, Made Bakta*, Tjok Gde Dharmayudha*, Jodi S Lukman**, Ketut Suwitra**

ABSTRACT

Aim: to explore the profile of anemia in pradialytic and dialytic CRF patients at the Division of Nephrology, Department of Internal Medicine, Sanglah Hospital, Denpasar, from January to June 2000.

Methods: there were 26 chronic dialyzed patients and 26 pradialyzed patients. Technicon H-1 was used to examine peripheral blood count; blood urea nitrogen and serum creatinine were examined using standard technique. MEIA (microparticle enzyme immunoassay) was used for serum folic acid and serum B12 level.

Results: of 52 CRF patients, hemoglobin (Hb) levels ranged from 4.6 g/dl to 15.1 g/dl with a mean of 9.3 ± 2.7 g/dl. Hematocrit levels ranged from 15.3 % to 49.3%, with a mean of 29.8 ± 7.9%. There was a significant difference in the hemoglobin and hematocrit levels of chronic dialyzed and pradialyzed patients. The prevalence of anemia (according to the WHO’s criteria) among CRF patients was 84.5% (45/52), with the prevalence in chronic dialyzed patients being 100% and 73.1% in pradialyzed patients. If a hemoglobin level of less than 10 g/dl is used as a cut off point, the prevalence of anemia in dialyzed patients was 96.2% and 30.8% among pradialyzed patients. The severity of anemia among 26 dialyzed patients was: severe in 2 cases (8%), moderate in 16 cases (64%) and mild in 7 cases (28%), while in pradialyzed patients the severity of anemia was: moderate in 4 patients (50%) and mild in 4 (50%). The morphology of 33 anemic patients was normochromic normocytic in 26 (78.8%) cases, slightly macrocytic in 7 (21.2%) cases, and no hypochromic anemia was found. Two anemic patients were associated with low serum folic acid (1 patient with macrocytic anemia and the other case with normochromic normocytic anemia). The serum B12 level was found to be normal in all cases. There was no significant correlation between the severity of anemia and serum creatinine levels or duration of hemodialysis.

Conclusion: anemia is a hallmark for CRF patients with a high prevalence of anemia and moderate degree of anemia. Most of anemic cases were normochromic normocytic. Loss of renal mass could be the principle mechanism. In a small proportion of patients, folic acid deficiency may be the cause of anemia. In this study, iron deficiency anemia was not likely an important factor since no hypochromic anemia was found.

Key words: anemia, CRF, folic acid.

INTRODUCTION

The association of chronic renal failure (CRF) and anemia has been recognized since the early 19th century, first noted by Richard Bright in 1836 when he observed pallor in the development of Bright’s disease. Nowadays, such a manifestation is regarded as one of the many components of the vast array of signs and symptoms present in patients with CRF. Anemia is defined in terms of low levels of hematocrit or hemoglobin. Anemia of renal failure begins relatively early in the development of kidney disease. As progressive destruction of kidney tissue occurs, the degree of anemia increases. Although there is a large degree of interpatient variability, the hematocrit generally begins to fall when the plasma creatinine concentration is above 2 mg/dl and gets progressively lower as glomerular filtration rate declines further.

A normocytic and normochromic red blood cell is a very common but not universal complication of CRF. While microcytic and hypochromic indices might suggest either iron deficiency or aluminium intoxication, macrocytic anemia due to folate and B12 deficiency can also occur in some CRF patients. On blood smears, occasional deformed, spiculated red cell (Burr cells) can be seen. The bone marrow shows erythroid hypoplasia.
with little or no interference with leukopoiesis or megakaryopoiesis.\textsuperscript{2,7}

Although inadequate production of erythropoietin by kidney tissues is most important factor in the pathogenesis of anemia in CRF, it is not the only one.\textsuperscript{8} Other factors play a role in contributing to mild anemia that is often present despite the use of recombinant human erythropoietin. Chief among these factors are shortened erythrocyte survival, blood loss, iron and other nutritional deficiency, and perhaps the effect of uremic inhibitors on the bone marrow. Severe hyperparathyroidism can lead to myelofibrosis in some CRF patients, hence suggesting a direct suppressive effect on erythropoiesis. Non-renal, non-dialysis factors can also superimpose themselves on the anemia of CRF. These include malignancy; drug-induced bleeding, infection and inflammation.\textsuperscript{1,6-9}

This study was conducted with the aim of exploring the profile of anemia in pradialytic and dialytic CRF patients.

**METHODS**

The subjects of this study were CRF patients who were treated at the Division of Nephrology, Department of Internal Medicine, Sanglah Hospital, Denpasar, during the period of January to June 2000. These patients consisted of 26 chronically dialyzed and 26 predialyzed CRF patients. Hemodialysis was performed twice weekly using a hollow fiber, with acetate buffer, blood flow 200 ml/min, and dialysate flow 400 ml/min. The nature and purpose of the study was carefully explained to all participants before they agreed to participate.

Venous blood was obtained from dialyzed patients on the morning of the day they were scheduled for a dialysis as well as from predialyzed patients. Technicon H-1 was used to examine peripheral blood count; blood urea nitrogen and serum creatinine were analyzed with standard local technique, while serum folic acid and serum B12 were obtained using MEIA (microparticle enzyme immunoassay). The classification and prevalence of anemia was based on the WHO’s criteria (1968).\textsuperscript{1,10}

Data for the prevalence, the severity and morphologic feature of anemia were presented descriptively. Simple and multiple linear regression analysis were used to assess the correlation between the levels of anemia with creatinine serum as well as between the levels of anemia and the duration of hemodialysis. Scattered diagrams are displayed to show the correlation between two variables. P<0.05 was considered significant.

**RESULTS**

From January to June 2000, there were 52 CRF patients included in this study treated at the Nephrology Division, Department of Internal Medicine, Sanglah Hospital Denpasar. They consisted of 26 chronic dialytic and another 26 predialytic patients. The characteristics of both dialytic and predialytic patients can be found in Tables 1 and 2.

Out of 26 pradialytic patients, 20 (76.9%) were older than 50 years, and there were more female patients than male patients.

**Table 1. The Characteristics of 26 Pradialytic Patients**

<table>
<thead>
<tr>
<th>Age (year)</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-29</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30-39</td>
<td>2</td>
<td>1</td>
<td>3 (11.5%)</td>
</tr>
<tr>
<td>40-49</td>
<td>1</td>
<td>2</td>
<td>3 (11.5%)</td>
</tr>
<tr>
<td>50-59</td>
<td>7</td>
<td>1</td>
<td>8 (30.7%)</td>
</tr>
<tr>
<td>60-69</td>
<td>1</td>
<td>3</td>
<td>6 (23.1%)</td>
</tr>
<tr>
<td>&gt; 70</td>
<td>5</td>
<td>1</td>
<td>6 (23.1%)</td>
</tr>
<tr>
<td>Total</td>
<td>18 (69%)</td>
<td>8 (31%)</td>
<td>26 (100%)</td>
</tr>
</tbody>
</table>

**Table 2. The Characteristics of 26 Dialytic Patients**

<table>
<thead>
<tr>
<th>Age (year)</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-29</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30-39</td>
<td>2</td>
<td>2</td>
<td>4 (15.4%)</td>
</tr>
<tr>
<td>40-49</td>
<td>6</td>
<td>4</td>
<td>10 (38.5%)</td>
</tr>
<tr>
<td>50-59</td>
<td>5</td>
<td>1</td>
<td>6 (23.1%)</td>
</tr>
<tr>
<td>60-69</td>
<td>5</td>
<td>1</td>
<td>6 (23.1%)</td>
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<tr>
<td>&gt; 70</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>18 (69%)</td>
<td>8 (31%)</td>
<td>26 (100%)</td>
</tr>
</tbody>
</table>

In the dialyzed group, the most frequent age group was 40-49 years (38.5%), and male patients outnumbered female patients.

Among 52 CRF patients, the hemoglobin (Hb) levels ranged from 4.6 g/dl to 15.1 g/dl, with a mean of 9.3 ± 2.7 g/dl. The hematocrit levels ranged from 15.3 % to 49.3%, with a mean of 29.8 ± 7.9%. There was a significant difference between chronic dialyzed and predialyzed patients on hemoglobin and hematocrit levels. The prevalence of anemia using WHO’s criteria was 84.5% (45/52) in all of the patients, 100% (26/26) among 26 dialytic group but only 73.1% (19/26) in predialytic patients. If a hemoglobin level of less than 10 g/dl was used as a cut off point for defining anemia, the prevalence of anemia among dialytic patients was 96.2% (25/26) and 30.8% (8/26) among predialytic patients.

In the predialytic group, there was no hypochromic microcytic anemia, but there were many patients with slight macrocytic anemia. The morphological feature of anemia among dialytic patients was dominated by normochromic...
normocytic type, as can be seen in table 4. The degree of anemia in CRF patients was found as in tables 5 and 6. Among the 8 anemic patients on predialyzed group, the prevalence of moderate anemia and mild anemia was distributed evenly, 50% respectively. Among the 26 dialytic patients, moderate anemia was the most frequent finding (64%), followed by mild anemia in 28% and severe anemia in 8%.

In an attempt to predict the relationship between hemoglobin level and serum creatinine level as well as the duration of hemodialysis, linear regression correlation was used. As shown in Figure 1, there was no significant association between hemoglobin level and duration of hemodialysis.

In Figure 1, the correlation between hemoglobin level and the duration of hemodialysis was not significant. Likewise, the correlation between hemoglobin level and serum creatinine was also not significant.

There were two patients found with low levels of serum folic acid. One of them had macrocytic anemia while the other had normochromic normocytic. The serum B12 level was found to be normal in all cases.

**DISCUSSION**

Anemia is a cardinal feature of CRF but not a universal complication of CRF. There is large variability in the prevalence of anemia as well as the severity of anemia itself. Anemia in CRF is usually evident when a patient’s creatinine clearance (CC) is less than 30 ml/min/1.73 m², glomerular filtration rate (GFR) is below 50-40 ml/min, or serum creatinine (SC) is more than 3 mg/dl. If the GFR is less than 20 ml/min or the SC of more than 5, anemia is invariably present, and the hemoglobin level is found below 10 g/dl. In this study, we found a prevalence of anemia in dialytic and pradialytic patients of 96.2% and 30.8% respectively. Suprapto et al in Semarang reported 100% anemia in 42 CRF patients they studied. The study used population-based data from the
before regular hemodialysis was initiated, none of the patients was nephrectomized. After 3 to 27 months of regular hemodialysis the hematocrit increased from 21% to 29%. During this time, no blood transfusion or androgen was given.12

The results of our study showed no significant correlation between hemoglobin level and duration of hemodialysis. One possible explanation may be inadequacy of the dialysis prescribed.

The mainstay of the treatment of anemia in CRF is the use of EPO.4,12-15 Upon initiation of therapy, a target hematocrit should be set, and the iron store should also be completely evaluated. Given the high cost of laboratory assessment, anemia screening before initiating EPO therapy should be limited to tests to identify iron deficiency.16,17 One study concluded that a combination of low dose of recombinant human EPO and androgen was effective treatment for anemia of CRF.18

CONCLUSION

The study shows that anemia is a hallmark in CRF patients, especially among those undergoing dialysis, where moderate anemia is the most frequent finding in both dialyzed or pradialyzed patients. Normocytic normochromic anemia dominated the anemic cases. There was a significant difference between chronic dialysis patients and pradialytic patients in hemoglobin and hematocrit levels, but no significant correlation was found between hemoglobin level and serum creatinine as well as duration of hemodialysis. Loss of renal mass could be the principle mechanism of anemia in CRF. In this study, iron deficiency was unlikely to be an important factor, because no hypochromic microcytic was found.

REFERENCES

5. Cordova HR, Benabe JE, Maldonado MM. Clinical manifestations and complications of the uremic state. In: Jacobson


