Objective
To study the prevalence and prognostic value of anemia in a population hospitalized due to decompensated heart failure.

Method
From July to September, 2001, 204 patients were included in a multicenter hospital registry of heart failure (EPICA Study – Niterói). This retrospective analysis comprised 142 patients with data about hematocrit and hemoglobin levels collected on hospital admission. The mean age was 69.5±13.3 years, and 72 (50.7%) patients were men. Hemoglobin levels < 13.5 g/dL for men and < 12 g/dL for women were considered anemia. The relation between anemia and in-hospital mortality was assessed through univariate and multivariate analysis with logistic regression.

Results
Anemia was observed in 89 (62.6%) patients, 52 (58%) men and 37 (42%) women. Mortality in anemic patients was 16.8% and, in nonanemic, it was 8% (P=0.11). In both sexes, the mortality rates in anemic and nonanemic patients were, respectively, 19.2% vs 0% (P=0.034) and 13.5% vs 12.2% (P=0.86). Through multivariate analysis, the following variables were found to be independently related to in-hospital mortality: hyponatremia (RR=7.0; 95% confidence interval (95% CI)=6.1 to 8.7; P=0.0001), anemia (RR=3.1; 95% CI=2.4 to 4.3; P=0.024), and presence of NYHA functional class IV (RR=1.9; 95% CI=1.3 to 2.6; P=0.04).

Conclusion
In the population studied with decompensated heart failure, the presence of anemia was an independent marker of in-hospital mortality. Mortality in the group with anemia was significantly high among men.

Key words
heart failure, anemia, prognosis
independent variables were age, sex, functional class, presence of systolic dysfunction, serum creatinine, presence of hyponatremia, presence of anemia, previous use of acetylsalicylic acid, and use of angiotensin-converting enzyme inhibitors. The significance level adopted was 5%, and the analysis was performed by using the SPSS statistical package, version 6.0.

Results

The basal characteristics of the patients are shown in table I. Anemia was observed in 89 (62.6%) patients, 52 (58%) being of the male sex and 37 (42%) of the female sex. Mortality was 16.8% in the anemic patients and 8% in nonanemic patients (P=0.11). In the male sex, in-hospital mortality was significantly greater among anemic patients than among nonanemic patients (19.2% vs 0%, respectively, P=0.034). In the female sex, no significant difference in mortality was observed between anemic and nonanemic patients (13.5% vs 12.2%, P=0.86) (fig. 1). No significant difference in mortality was observed between the group analyzed and the 62 patients who were excluded from the analysis because they did not have data on hematocrit and hemoglobin (13% vs 11%, P=0.38). The characteristics of the patients who survived and those who did not survive are shown in table II.

No significant difference was observed between the anemic and nonanemic groups in regard to the use of acetylsalicylic acid, use of angiotensin-converting enzyme inhibitors, serum creatinine, and serum sodium.

The logistic regression analysis showed that the following variables were independently related to in-hospital mortality: hyponatremia (RR=7.0; 95% confidence interval (95%CI)=6.1 to 8.7; P=0.0001), anemia (RR=3.1; 95% CI=2.4 to 4.3; P=0.024), and the presence of NYHA functional class IV (RR=1.9; 95% CI=1.3 to 2.6; P=0.04) (tab. III).

Discussion

Anemia is a comorbidity whose prognostic importance has been well recognized in a series of cardiovascular diseases, acute myocardial infarction included. In heart failure, anemia has only recently received attention, and its prevalence has ranged from 16 to 48%, depending on the age of the patients studied, the severity of the disease, and the criteria used for the diagnosis of anemia. In our study, a high prevalence of anemia (63%) was found, which may be explained by the predominance of elderly patients with advanced heart failure, although that prevalence may have been overestimated by the limitations of a retrospective study.

Data in the literature have also suggested that, in addition to being frequent, anemia relates to prognosis. In a study with 1,061 patients 5, mortality at different hemoglobin levels was as follows: hemoglobin < 12.3 g/dL, 44.4%; between 12.3 and 13.6 g/dL, 36.1%; between 13.7 and 14.8 g/dL, 28.6%; and hemoglobin > 14.8 g/dL, 25.6%. In our study, anemia was an independent predictor of mortality. In univariate analysis, greater mortality was observed in men with anemia than in those without anemia. Interestingly, among women, no difference in mortality was observed. This difference regarding sex requires further investigation. However, at least one other author 8 has found that relation pre-
Anemia as a Prognostic Factor in a Population Hospitalized due to Decompensated Heart Failure

Table II – Clinical characteristics of survivors and nonsurvivors

<table>
<thead>
<tr>
<th>Variables</th>
<th>Survivors n = 123</th>
<th>Nonsurvivors n = 19</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>66.5±13.2</td>
<td>71±14.2</td>
<td>0.11</td>
</tr>
<tr>
<td>Male sex</td>
<td>62 (50.4%)</td>
<td>10 (52.6%)</td>
<td>0.85</td>
</tr>
<tr>
<td>(NYHA) FC IV</td>
<td>79.6%</td>
<td>94.7%</td>
<td>0.02</td>
</tr>
<tr>
<td>Ischemic etiology</td>
<td>76 (61.7%)</td>
<td>12 (63.1%)</td>
<td>0.58</td>
</tr>
<tr>
<td>Serum creatinine (mg/dL)</td>
<td>1.4±0.7</td>
<td>1.3±0.6</td>
<td>0.22</td>
</tr>
<tr>
<td>Serum sodium (mEq/L)</td>
<td>136±42</td>
<td>130±38</td>
<td>0.01</td>
</tr>
<tr>
<td>Hemoglobin (g/dL)</td>
<td>12.8±1.3</td>
<td>11.6±1.4</td>
<td>0.06</td>
</tr>
<tr>
<td>Systolic dysfunction</td>
<td>95 (77.2%)</td>
<td>15 (79%)</td>
<td>0.54</td>
</tr>
<tr>
<td>Use of ASA</td>
<td>57 (46.3%)</td>
<td>9 (47.3%)</td>
<td>0.87</td>
</tr>
<tr>
<td>Use of ACEI</td>
<td>88 (71.5%)</td>
<td>13 (68.4%)</td>
<td>0.68</td>
</tr>
</tbody>
</table>

ASA - acetylsalicylic acid; ACEI - angiotensin-converting enzyme inhibitor; (NYHA) FC IV - New York Heart Association functional class IV.

Table III - Multivariate analysis through logistic regression

<table>
<thead>
<tr>
<th>Variable</th>
<th>Beta coefficient</th>
<th>Standard error</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyponatremia</td>
<td>4.5793</td>
<td>1.1596</td>
<td>0.0001</td>
</tr>
<tr>
<td>Anemia</td>
<td>2.5743</td>
<td>1.1479</td>
<td>0.0240</td>
</tr>
<tr>
<td>(NYHA) FC IV</td>
<td>2.2167</td>
<td>1.1260</td>
<td>0.0470</td>
</tr>
</tbody>
</table>

(NYHA) FC IV - New York Heart Association functional class IV.

converting enzyme inhibitors. Analyzing all this information, one may conclude that anemia may have a cause and effect relation with prognosis.

In heart failure, the cause of anemia seems to be multifactorial. Several mechanisms have been proposed, such as the presence of alteration in renal function due to its severity and aggravated by the use of diuretics, the use of acetylsalicylic acid, the inhibition of the production of erythropoietin by the angiotensin-converting enzyme inhibitor, and hemodilution. Another possible cause that has been gaining attention is the suppression of erythropoietin and erythropoiesis by inflammatory cytokines, which are increased in heart failure.

Our study has a significant clinical implication. As anemia is an independent prognostic factor, one may influence its evolution through its correction. Some studies with a limited number of patients have shown that the correction of anemia with erythropoietin and intravenous iron has improved the functional class, reduced hospitalizations, and improved ejection fraction. In another study, treatment with erythropoietin improved the functional capacity of the patients with heart failure and anemia.

An important limitation of our study is the fact that it is a retrospective analysis, which limits the control of some variables whose data were not available. Therefore, the type of anemia of those patients could not be established. It is worth noting, however, that this study was developed using a database whose information was collected prospectively. In addition, it reproduces the same results already reported by other authors.

In conclusion, the presence of anemia was a prognostic factor independent of events, and this association was important, particularly in the male sex.

References