a monographic clinic (specialized in patients with stage 4 and 5 CKD not on dialysis with a GFR lower than 30 ml/min/1.73 m² body surface) and receiving from 3000 to 8000 IU/week of epoetin β, or equivalent doses of darbepoetin α (15-40 µg/week), with stable hemoglobin (variation in hemoglobin level less than ± 0.5 g/dL in the three months prior to initiation of the study) and stable iron deposits, demonstrated by a transferrin saturation index greater than 20%. The exclusion criteria were: suspected or confirmed active bleeding, active malignancy, hospital admission or severe inflammatory disease in the three months prior to initiation of the study.

Variables analyzed

We identified age, sex, etiology of kidney disease, presence of arterial hypertension defined as blood pressure greater than 130/85 mmHg or treatment with antihypertensive drugs regardless of the blood pressure value, diabetes mellitus, weight, height, body mass index and weekly doses of epoetin β or darbepoetin α.

Laboratory tests were performed every three months, starting from the three months prior to initiation of the study, these tests included hemoglobin (g/L), hematocrit (%), ferritin (µg/L), Transferrin saturation index (TSI, %), kidney function expressed by means of serum creatinine levels (mg/dL) and estimated glomerular filtration rate (eGFR) calculated by means of the CKD-EPI formula, serum albumin (g/dL) and proteinuria (g/24h).

Using the same time intervals, the erythropoietin resistance index (ERI) (IU/kg/week/g/dL) or equivalent dose of darbepoetin α using a dose conversion ratio of 1:200 was calculated. For the estimation of the ERI in patients treated with CERA, the mean equivalent doses of CERA and the rest of the ESAs were estimated according to table 1 (1 µg/week: 225 IU/week) with respect to epoetin β.

In every visit, patients were questioned about possible adverse effects. Intravenous (IV) iron was administered as ferric hydroxide sucrose (5 mL vial containing 20 mg/mL of elemental iron) at varying intervals to maintain a TSI > 20% and ferritin > 100 µg/L.

Statistical analysis

Normally distributed quantitative variables are expressed as mean and standard deviation (SD) and qualitative variables as percentages. Student’s t-test for independent samples was used to compare quantitative variables and the chi-square test was used for qualitative variables. P-values less than 0.05 were considered significant. Data processing and analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 15.0 (SPSS Inc., Chicago, IL, USA).

Results

Baseline characteristics

The baseline characteristics of the overall population and of each individual subgroup (CERA and control)