Examination of the rate of hypochromic red blood cells for monitoring iron-deficiency in haemodialyzed patients

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Background
It is essential to monitor iron-deficiency in renal anaemic patients. The medical protocols proposed to measure transferrin saturation and serum ferritin levels.

Objectives
We have presumed that the hypochromic red blood cell rate (HRBCr) is a sufficient method for defining the measure of patients’ iron-deficiency (ID).

Monitoring of the iron deficiency

- Serum ferritin
  - The serum ferritin level is an indication of iron stores.
  - Its level is affected by inflammation, hepatic and malignant diseases.
  - One must interrupt the administration of i.v. iron two weeks before its checking.
  - The cost of serum ferritin level’s check is relatively high.

- Transferrin saturation (TSAT)
  - It means the immediate iron availability for red blood cells (RBC) production is best assessed by measuring total serum iron and total iron-binding capacity (ratio of them in percentages).

- Red blood cells haemoglobin concentration
  - RBCs in renal failure are typically normocytic and normochromic. Microcytic changes or hypochromia suggest the presence of iron deficiency.

- Percentage of hypochromic red cells is a simple lab test.

- Other “Iron” tests
  - reticulocyte haemoglobin content
  - soluble transferrin receptor
  - serum transferrin level
  - hepcidin

Methods
We measured HRBCr on a monthly basis in dialysis patients. The rate of HRBCr >10% is absolute ID, between 5-10% is relative ID, and <5% ID excludes ID. We analyzed our dialysis patients’ haematology parameters, erythropoietin (EPO) and iron doses and the haemoglobin (Hgb) target achievement rate.

Patients
We treated 284 patients in 2011, 271 in 2012, 279 in 2013 and 281 in 2014 in chronic haemodialysis program. The mean age of them was 65.4, 65.8, 62.5, 62.6 years respectively. The monthly average chronic haemodialyzed patient’s number was 184 (2011), 170 (2012), 173 (2013) and 178 (2014).

The rate of patients who received EPO was 97% (2011), 89% (2012), 84% (2013) and 86% (2014).

Types of iron deficiency

- Absolute iron deficiency
  - serum ferritin < 100 μg/L
  - TSAT < 20%
  - HRBCr > 10%

- Functional iron deficiency
  - serum ferritin > 100 μg/L
  - TSAT < 20%
  - HRBCr between 5-10%

Starting dosage of i.v. iron supplementation
500-600 mg in first 2-3 weeks
250-300 mg in first 2-3 weeks

Maintainer dosage of i.v. iron supplementation
50-125 mg/2 weeks

Results

The rate of hypochromic red blood cell in our patients on chronic haemodialysis program between 2012-2014, quarterly

The mean of hypochromic red blood cell rate (%) and average iron dose in our dialysis centre between 2011–2014

The mean hypochromic red blood cell rate and average iron dose between 2011–2014 quarterly

Conclusions
Our experience verifies that HRNCr is an appropriate method for the identification of iron deficiency. It is a simple, cost effective and reliable labor tool. In the last 4 years we could control the iron status of our patients refining their iron need while also significantly decreasing the EPO dosage.