Red Cell Distribution Width: A Method That Improves Detection of Iron Deficiency in Chronic Hemodialysis Patients

R.	Rafael	Díaz-Tejeiro ^a
F.	Francisco	Maduell ^a
J.	Javier	Diez ^b
N.	Noemi	Esparza ^a
P.	Pedro	Errasti ^a
A.	Andres	Purroy ^a

^aDepartment of Nephrology, University Clinic, School of Medicine, University of Navarra, Pamplona; ^bDepartment of Medicine, University of Zaragoza, Spain

Rafael Díaz-Tejeiro, MD, Department of Nephrology, University Clinic, School of Medicine, University of Navarra, E-31080 Pamplona (Spain)

Dear Sir,

The pathogenesis of anemia of maintenance hemodialysis patients is multifactorial. Superimposed iron deficiency because of the repetitive blood losses associated with dialyzer use and bleeding secondary to uremic gastroenteritis and platelet dysfunction is a common feature [1].

The sensitivity of various iron measurements varies with the severity of iron lack. On this basis iron deficiency is commonly divided into three stages: storage iron depletion, iron-deficient erythropoiesis and iron deficiency anemia [2]. Red cell indices, such as mean corpuscular volumen (MCV), mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration, are sensitive only in the second and the third stages [2]. Moreover, several reports have shown that the serum iron and trans-ferrin saturation are of little value in identifying iron deficiency in these patients [3]. Serial measurements of serum ferritin levels provide an acceptable alternative for monitoring iron balance in chronic hemodialysis patients [4]. The majority of studies have suggested that iron deficiency is associated with serum ferritin values of less than 55 ng/dl [5]. The use of a new red blood cell parameter, the red blood cell distribution width (RDW), which is offered as a routine parameter on automated blood count, in combination with MCV improves the classification of anemias and the early detection of iron deficiency [6, 7]. It has been demonstrated that RDW values greater than 14.6% are associated with decreased iron stores [6].

To evaluate the usefulness of the RDW in detecting iron deficiency we examined blood samples from 27 patients in maintenance hemodialysis. Patients with morphologically identified red cell abnormalities and patients with MCV values greater than 100 fl were excluded because these abnormalities may also cause RDW elevation. All patients were treated with phosphate binders

Table 1. Relation of MCV and MCV/RDW with serum ferritin in 27 patients in chronic hemodialysis

FerritinPatients

MCV

Decreased	decreased	4 ^a
Decreased	normal	2 ^b
Normal	normal	14 ^c
Normal	decreased	7 ^d

MCV/RDW

Decreased/increased	decreased	8 ^a
Decreased/increased	normal	4 ^b
Normal	normal	12 ^c
Normal	decreased	3 ^d

^a True positives.

^b False positives.

^c True negatives.

^d False negatives.

(aluminium hydroxide and/or calcium carbonate), calcium citriol and antihypertensive drugs. Three patients were under treatment with desferrioxamine (DFO) to chelate aluminium. RDW and MCV were determined by blood count with a Technicon Model HI with standard calibration.

Serum ferritin was determined by RIA method, to test an accurate guide of iron stores.

Sensitivity, specificity, and predictive values were calculated with standard formulas [8].

Using the ferritin levels, 11 patients were ferropenic, 3 of them were under treatment with DFO.

The relationships between MCV alone and serum ferritin, and MCV plus RDW and serum ferritin are illustrated in table 1. The sensitivity of MCV alone in determining the likelihood of iron store depletion was 36 versus 72% of MCV + RDW. The association of decreased ferritin lev-

lev-

380

Díaz-Tejeiro/Maduell/Diez/Esparza/Errasti/Purroy

Cook JD: Clinical evaluation of iron deficiency. *Semin Hematol* 1982;191:6–18.

Parker PA, Izar MW, Maher FJ: Therapy of iron deficiency anemia in patients on maintenance dialysis. *Nephron* 1979;23:181–186.

Eschbach JW, Cook JD, Scribner BH, et al: Iron balance in hemodialysis patients. *Ann Intern Med* 1977;87:710–713.

Lynn KL, Mitchell TR, Thepperd J: Serum ferritin concentration in patients receiving maintenance hemodialysis. *Clin Nephrol* 1980;14:124–127.

Bessman JD, Gilmer PR, Gardner FH: Improved classification of anemias by MCV and RDW. *Am J Clin Pathol* 1983; 80: 322–326.

McClure S, Custer E, Besman JD: Improved detection of early deficiency in non-anemic subjects. *JAMA* 1985; 253:1021–1023.

Galen RS, Gambino RS: Beyond normality: The predictive value and efficiency of medical diagnoses. New York, Wiley, 1975, pp 10–14.

Morgan DL, Peck SD: The use of red cell distribution width in the detection of iron deficiency in chronic hemodialysis patients. *Am J Clin Pathol* 1988;89:513–515.

els and abnormal MCV + RDW values was statistically 2 significant ($p < 0.01$, by the Fisher test). The specificity of MCV in predicting iron deficiency was 87 versus 75% of MCV + RDW. The positive and negative predictive values of the MCV with respect to iron deficiency were both 66%, and of the MCV + RDW were 66 and 80%, respectively. The mean corpuscular

hemoglobin and mean corpuscular hemoglobin concentration do not improve the sensitivity of MCV alone in the detection of iron deficiency.

The results presented here confirm that RDW appears to be a sensitive and specific screening for the detection of iron deficiency in patients on chronic hemodialysis [9]. Since the red blood cell RDW is an easy, fast, noninvasive and nonexpensive method of screening in the detection of iron deficiency, we suggest that it can be used as a guide to select patient candidates for serum ferritin determination and/or iron replacement and to perform the follow-up treatment with DFO.

References

1 Eschbach JW

Adamson JW: Anemia in renal disease; in Schrier RW

Gottschalk CW (eds): Diseases of the Kidney. Boston

Little

Brown

1988

vol 3

pp 3019–3034.