



**Figure 1.** Light scatter properties of analyzed cells (top). The flow cytometric dot plots clearly show that virtually all CD19<sup>+</sup> cells are positive for CD5 antigen and there are two cell populations with different HLA-DR antigen expression pattern. CD33 antigen is found to be the only antigen that expressed more than 50% of the cells and most of them are negative for HLA-DR antigen.

nosis but we do not have any doubts about the diagnosis because more than  $10 \times 10^9/L$  cells expressed CD5, CD19, CD20 and CD22 (Figure 1).

The concomitant presentation of AML and CLL is extremely rare and the use of two-color flow cytometry to differentiate the cell populations demonstrates the utility of this technology in the diagnosis of unusual hematologic malignancies.

Mustafa Nuri Yenerel,\* Ibrahim Hatemi,<sup>o</sup> Hüseyin Keskin\*

\*Istanbul University, Istanbul Medical School, Department of Internal Medicine, Division of Hematology, Çapa, Istanbul; <sup>o</sup>Haseki State Hospital, Haseki, Istanbul, Turkey

### Key words

CCL, AML, flow cytometry.

### Correspondence

Mustafa Nuri Yenerel, MD, Istanbul University, Istanbul Medical School, Department of Internal Medicine, Division of Hematology, Çapa, Istanbul, Turkey. Fax: international +90.212.6311263.

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### Acute megaloblastic anemia: homocysteine levels are useful for diagnosis and follow-up

Sir,

Vitamin B<sub>12</sub> (cobalamin) and folic acid deficiencies lead to megaloblastic anemia (MA), and induce accumulation of methylmalonic acid (MMA) and homocysteine (HCY).<sup>1</sup> The most common presentation of MA is classical macrocytic anemia. Other presentations are acute megaloblastosis (AM) and masked megaloblastosis.<sup>2,3</sup> In this report, we present a case of AM diagnosed and followed up by evaluation of HCY levels.

A 45-year old male was diagnosed as having Philadelphia-positive chronic myelogenous leukemia. Three years after diagnosis the patient developed a lymphoid blast crisis and was started on a chemotherapy protocol. The first consolidation treatment consisted of 6-mercaptopurine, methotrexate (MTX), VM-26 and cytarabine. MTX rescue with folinic acid was performed following standard guidelines. On day +14 a platelet count of  $9 \times 10^9/L$  was found. Hb was 99 g/L, mean corpuscular volume (MCV) 92 fL and leukocyte count was  $7.06 \times 10^9/L$  with 84% of neutrophils with hypersegmentation. Reticulocyte count was  $0.053 \times 10^{12}/L$  (1.66%). Vitamin B<sub>12</sub> levels and red cell folate were 322 pmol/L (normal 150-1200) and 938 nmol/L (normal 441-1285), respectively. A BM aspirate revealed 30% of erythroid precursors with megaloblastic features and a 55% of myeloid precursors with increased size and no blast cells. Serum HCY levels were 38 µmol/L (normal < 16). The

**Table 1. Evolution of analytical parameters during folic acid and vitamin B<sub>12</sub> treatment.**

	Pre-treatment Day -9	Onset Day 0	Post-treatment Day +9
Platelets (x10 <sup>9</sup> /L)	134	9	112
Leukocytes (x10 <sup>9</sup> /L)	6.76	7.06	5.72
Hemoglobin (g/L)	91	99	95
MCV (fL)	93	92	95.3
Reticulocytes (x10 <sup>12</sup> /L)	0.037	0.053	0.163
Homocysteine (µmol/L)	-	38	9

AM, acute megaloblastosis; MCV, mean corpuscular volume.

patient was diagnosed as having AM and began treatment with folic acid 12 mg iv in one single dose and folic acid 5 mg/day po for 14 days and parenteral vitamin B<sub>12</sub> 2 mg/day for 4 consecutive days. After 10 days of treatment the platelet count increased to 112×10<sup>9</sup>/L and reticulocyte count to 0.163×10<sup>12</sup>/L (5.41%). Vitamin B<sub>12</sub> level was 716 pmol/L, red cell folate level 1,506 nmol/L and serum HCY level decreased to normal value (9 µmol/L) (Table 1).

Four different clinical forms of megaloblastosis have been described.<sup>3,4</sup> The classical form has an insidious onset with frequent neurologic symptoms and macrocytic anemia. Vitamin B<sub>12</sub> and/or red cell folate levels are decreased. The second form is the subtle MA anemia with ill-defined clinical symptoms and decreased or borderline vitamin B<sub>12</sub> and folic acid levels with other abnormalities (dUST, HCY, MMA).<sup>2</sup> Masked megaloblastosis coexists with other deficiencies; MCV is normal or decreased.<sup>5,6</sup> MA of acute onset is the rarest form.<sup>3</sup> There are two clinical presentations; the masked undiagnosed classical MA with cytopenias of abrupt onset and the so-called AM.<sup>3-7</sup> In AM severe thrombocytopenia develops in 1 to 3 weeks, MCV is normal or only moderately increased. This presentation is more frequent in patients with risk factors: parenteral nutrition, infection, dialysis or treatment with some antifolate drugs. Mortality is high.<sup>3</sup> The reticulocyte count is low. Vitamin B<sub>12</sub> and red cell folate levels are normal. BM aspirate shows megaloblastic changes. Classically, dUST is used as a diagnostic test. Nevertheless, HCY serum assays provide a sensitive test for the diagnosis of AM, especially in its early stages.<sup>8</sup> In vitamin B<sub>12</sub> deficiencies both HCY and MMA levels are high. In

folate deficiencies only HCY concentration is increased.<sup>9,10</sup> HCY levels are also useful for AM follow-up of AM; levels return to normal after starting treatment with vitamin B<sub>12</sub> or folic acid. The evaluation of serum HCY levels is an easy and non-invasive test for the diagnosis and follow-up of AM.

Marina Carrasco, Angel Remacha, Anna Sureda,  
Pilar Sardà, Rodrigo Martino, Jorge Sierra.

Department of Hematology, Hospital de la Santa Creu i Sant Pau,  
Barcelona, Spain.

### Key words

Acute megaloblastosis, folic acid, cobalamin, homocysteine

### Correspondence

Angel Remacha Sevilla, MD, Laboratorio de Hematología,  
Hospital de la Santa Creu i Sant Pau, Antoni Maria i Claret,  
167, 08025 Barcelona, Spain. Phone: international +34-93-2919290 – Fax: international +34-93-2919192 – E-mail: 2107@hsp.santpau.es

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