Clinical Significance of MCV, MPV, SF and LDH Levels in Old Patients with Myelodysplastic Syndromes

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Abstract: Objective: The aim of this study was to investigate the clinical significance of mean corpuscular volume (MCV), mean platelet volume (MPV), serum ferritin (SF) and lactate dehydrogenase(LDH) levels to determine the useful laboratory markers for diagnosis and prognostic evaluation of MDS.Methods: MCV, MPV, SF and LDH levels were compared in MDS group with that in normal control group. MDS patients were divided into 4 groups according to the International Prognostic Scoring System (IPSS): low -risk, intermediate risk-I, intermediate risk-II and high-risk. We compared MCV, MPV, SF and LDH levels among the four groups. Results: 1.The MCV, MPV, SF and LDH levels in MDS group are significantly higher than that in normal control group(all $P<0.05$). 2.There were significant differences in serum LDH levels among the 4 groups of MDS (all $P<0.05$), and serum LDH levels increased in turn: low -risk, intermediate risk I, intermediate riskIIand high-risk. There were no significant differences in MCV, MPV, and SF levels among four groups.(all $P>0.05$)Conclusion: Detection of the MCV, MPV, SF and LDH levels is valuable in clinical diagnosis of MDS, and the LDH level seems to be valuable for prognostic evaluation of the MDS besides IPSS scoring system.

Keywords: Myelodysplastic syndromes; MCV; MPV; Serum ferritin, Lactate dehydrogenase

1. Introduction

The MDS is a group of clonal haematopoietic stem cell abnormities, which is characterized by cytopenia, dysplasia in one or more of the myeloid lineages, ineffective haematopoiesis, reproducible genetic abnormalities and increased risk of advancing leukemia. MDS occurs mainly in elder adults and median patient age is 70 years old, with a male superiority. A major diagnostic difficulty of MDS is the judgement of whether the morphological dysplasia and cytopenia are due to a clonal disorder or another factor. According to WHO, MDS has been comprehensively diagnosed by morphology, genetics, immunophenotype and molecular biology. The characteristics clinical manifestations and laboratory examination of MDS all have obvious heterogeneity which brings difficulties for the diagnosis, especially the recognition of early MDS.[1-2] At present, comprehensive diagnosis of various laboratory markers has gradually become a new concept of MDS diagnosis. Several reports of useful laboratory markers for the diagnosis and prognostic prediction of MDS have been reported. [3-5] In this article we retrospectively observed the laboratory indicators such as MCV, MPV, SF and LDH of the elderly patients newly diagnosed with MDS. The aim of this study was to investigate the clinical significance of MCV, MPV, SF and LDH detection in diagnosis and prognosis judgement for patients with MDS.

2. Patients and Methods

2.1. Patients

We analyzed data from elderly patients between 2013 and 2018 at the Affiliated Hospital of Engineering University of Hebei. These patients exhibited different types of MDS. Diagnostic standard based on 2008 WHO diagnosis and classification of MDS. There were 31 males and 29 females, with a median age of 69. (range 60-89). 13 of the MDS patients were refractory amemia, (group of RA); 10 of the MDS patients were RARS; 6 of the MDS patients were RCMD, 29 of the MDS patients were RAEB, 2 of the MDS patients were MDS-U. According to International Prognostic Scoring System(IPSS), the

MDS patients were divided into 4 groups: low -risk(13 cases), intermediate risk-Ⅰ(23 cases), intermediate risk-Ⅱ(13 cases) and high-risk (11 cases). All patients were diagnosed with the criteria based on the 2008 WHO classification, and they had no previous history of megaloblastic anemia, liver, kidney and heart diseases, diabetes, other malignancies and diseases that causes dysplasia. There was no statistically significant differences with respect to age and gender between groups, and data between the groups were comparable.

2.2. Collection of data

We analyzed laboratory data at the first diagnosis, which included MCV, MPV, SF and LDH levels. MCV and MPV were detected by using Mindray BC 6800 automated hematology analyzer , with a reference range of 82-100 fl and 7-13 fl. LDH was determined by the enzyme reaction rate method using Hitachi 7180 automatic biochemical analyzer, with a reference range of 15-220 U/L. SF was detected by electrochemiluminescence assay using Siemens XP automatic chemiluminescence analyzer, with a reference range of 21-274 ng/ml. The MCV, MPV, SF and LDH levels in MDS patients were compared with that in control group, and we also compared the MCV, MPV, SF and LDH levels among 4 MDS groups(low -risk , intermediate risk-I , intermediate risk-IIand high-risk groups) before the first cycle of chemotherapy.

2.3. Statistical analysis

The SPSS16.0 software package was used for the statistical tests. The difference of measurement data was compared with t test and one-way ANOVA and LSD were used for evaluating the relationship among the groups.

3. Results

The MCV, MPV, SF and LDH levels in MDS group are significantly higher than that in normal control group(all P<0.05). (Table 1)

Table 1. Levels of MCV，MPV，SF and LDH in normal control group and patients with MDS(mean±SD)

Group	n	MCV(fl)	MPV(fl)	SF（ng/ml）	LDH(U /L)
Normal control	60	89．72 ± 9.27	10.46±1.89	181.95± 99.27	141.97±117.66
MDS	60	99.77± 10.21*	11.78±2.01*	507.27±269.02*	327.08±121.19*

* P<0.05, compared with normal control group.

There were significant differences in serum LDH levels among the 4 groups of MDS (P ＜0.05), and serum LDH levels increased in turn: low -risk, intermediate risk I, intermediate risk IIand high-risk. There were no significant differences in MCV, MPV, and SF levels among four groups. (all P>0.05) (Table 2)

Table 2. Levels of MCV，MPV，SF and LDH in MDS patients with different risks according to the IPSS(mean±SD)

Risk	n	MCV(fl)	MPV(fl)	SF（ng/ml）	LDH(U /L)
Low	13	100.26±11.37	11.65±1.21	509.23±298.09	193.05±113.77*
Intermediate-Ⅰ	23	99.38±10.71	12.12±2.96	515.34±303.22	301.64± 143.18*
Intermediate-Ⅱ	13	101.27±11.49	11.38±2.25	500.28±313.14	360.48±149.91*
High	11	98.22±12.33	11.71±1.09	496.33±298.21	499.22±313.34*

* P<0.05, compared among 4 groups. IPSS: International Prognostic Scoring System

4. Discussion

The MDS is a group of clonal haematopoietic stem cell abnormities, which is characterized by cytopenia, dysplasia in one or more of the myeloid lineages, ineffective haematopoiesis, reproducible genetic abnormalities and increased risk of advancing leukemia. A major diagnostic difficulties of MDS is the judgement of whether the morphological dysplasia and cytopenia are due to a clonal disorder or another factor. Even if dysplasia is prominent, it's not in itself definitive evidence of a clonal process. At present, comprehensive diagnosis of various laboratory markers has gradually become a new concept of MDS diagnosis. In this study, We investigated the clinical significance of MCV, MPV, SF and LDH detection in diagnosis and prognosis judgement for patients with MDS.

LDH is a glycolytic enzyme, which is abundant in red blood cells, and mainly in myocardium, skeletal muscle and kidney of human. Elevated LDH levels have frequently been observed in animal and human malignancies. In addition, there appears to be a strong correlation between the disease activity and LDH levels. Besides, serum LDH level will increase due to the injury of tissues in human body. Serum LDH level will increase in certain malignancies, especially in hematologic malignancy. In addition, the level of serum LDH can reflect the invasive degree of tumor cells and be correlated with disease progression and prognosis in MDS patients. The frequent

performance of LDH levels can indicate the trends in MDS development.[6-7]

There is the highest concentration of SF in mononuclear macrophages in the bone marrow and spleen, which is one of the main forms of iron storage. The level of SF has diagnostic value for iron deficiency anemia. Abnormal hematopoiesis results in abnormal iron metabolism and the disorders of iron utilization, and invalid hematopoiesis and excessive destruction of red blood cells in MDS patients lead to increased iron release; due to the certain malignant biological behavior in MDS, ferritin isomers secreted from tumor cells lead to increased ferritin synthesis. Thus, SF significantly increases. Erythrocyte dysplasia in MDS is mostly manifested as macrocytic changes of red cells. Thus, MCV in MDS significantly increases. Large and deformed platelet leads to increased MPV, and it is consistent with the platelet morphology in MDS patients. [8]

To sum up, this study shows detection of the MCV, MPV, SF and LDH levels is valuable in clinical diagnosis of MDS, and the LDH level seems to be valuable for prognostic evaluation of the MDS besides IPSS scoring system.

References

[1] Garcia-Manero G. Myelodysplastic syndromes: 2014 update on diagnosis, risk-stratification, and management[J]. Am J Hematol, 2014, 89(1) : 97-108.

[2] Estey E. Acute myeloid leukemia and myelodysplastic syndromes in older patients[J]. Journal of Clinical Oncology, 2007, 25(14): 1908-1915.

[3] Berer A, Jager E, Sagaster V. Circulating myeloid colony forming cells predict survival in myelodysplastic syndromes. Ann Hematol, 2003; 82(5): 271- 277.

[4] Malcovati L, Papaemmanuil E, Bowen D T, et al. Clinical significance of SF3B1 mutations in myelodysplastic syndromes and myelodysplastic/myeloproliferative neoplasms.[J]. Blood, 2011, 118(24): 6239-6246.

[5] Gatto S, Ball G, Onida F, et al. Contribution of beta 2-microglobulin levels to the prognostic stratification of survival in patients with myelodysplastic syndrome (MDS). Blood, 2003, 102(5): 1622-1625.

[6] Wimazal F, Sperr WR, Kundi M, et al. Prognostic significance of serial determinations of lactate dehydrogenase(LDH) in the follow up of patients with myelodysplastic syndromes. Ann Oncol, 2008, 19(5): 970-976.

[7] Moon J H, Kim SNKang B W, Chae Y S, et al. Predictive value of pretreatment risk group and baseline LDH levels in MDS patients receiving azacitidine treatment[J]. Annals of Hematology, 2010, 89(7): 681.

[8] Bowles K M, Warner B A, Baglin T P. Platelet mass has prognostic value in patients with myelodysplastic syndromes[J]. British Journal of Haematology, 2010, 135(2): 198-200.