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Original research article

Evaluation of simple blood counts as inflammation markers for brain tumor patients

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ARTICLE INFO

Article history:
Received 30 April 2015
Accepted 7 March 2016
Available online 19 March 2016

Keywords:
Brain tumor
Metastasis
Mean platelet volume
Red cell distribution width
Inflammation

ABSTRACT

Aims: Hemogram parameters in routine blood panels have been proposed as inflammation markers. These parameters, especially the red cell distribution width (RDW) and mean platelet volume (MPV), were evaluated as surrogate inflammatory markers in brain tumor patients. We aimed to observe RDW and MPV values of tumor patients and compare to those in healthy population.

Methods: We recorded white blood cell count, neutrophil count, lymphocyte count, hemoglobin, hematocrit, RDW, platelet count, and MPV of the study group at the time of diagnosis and compared to those of the control subjects.

Results: The RDW was significantly elevated in study group compared to that of the control subjects ($p = 0.001$). The MPV was significantly lower in study group than that of the control group ($p = 0.01$).

Conclusion: Decreased MPV and increased RDW were both associated with brain tumor. However, prospective studies with larger sample sizes are needed to support the results and expose MPV and RDW variations between metastatic and primary brain tumors.

1. Introduction

The inflammatory response plays a crucial role in neoplastic diseases and closely correlates with tumor progression and metastasis [1–3]. The severity of inflammation serves as an important indicator of tumor progression and survival among patients with cancer [2,4,5]. Additionally, inflammatory molecules have been shown to be overexpressed by tumor cells [6].

The hemogram parameters in routine blood panels have been proposed as markers of inflammation [7]. The size variability of erythrocytes has been reported in terms of the red cell distribution width (RDW) value in hemogram assays, with higher RDW meaning higher variability. The RDW levels are elevated in iron deficiency anemia. Elevation in RDW has also been associated with inflammatory conditions [7–10].

Platelets are the smallest product of bone marrow in the blood stream, and they have a crucial role in hemostasis and inflammation. They are involved in the inflammatory

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http://dx.doi.org/10.1016/j.pjnns.2016.03.002

Table 1 – Characteristics and data of patients in the brain tumor and control groups.

		Brain tumor group	Control group	p
Gender	Men (n)	27	26	0.83
	Women (n)	21	22	
		Median (Min–Max)[a]		
Age (years)		40.5 (13–71)	43 (32–51)	0.38
Lymphocyte count (k/mm^3)		2 (0.7–3.8)	2.1 (1.5–3.7)	0.24
Neutrophil/lymphocyte ratio (%)		2.4 (1.1–7.5)	2 (0.6–3.5)	0.11
Hemoglobin (g/dL)		14.4 (10.2–16.4)	14.6 (12.3–17.5)	0.30
Hematocrit (%)		43 (30–50)	44 (36.5–53)	0.77
Mean corpuscular volume (fL)		86 (63–94)	87 (73–98)	0.09
Mean platelet volume (fL)		8.2 (6.3–10.5)	8.9 (6–10)	**0.01**
		Mean ± standard deviation[b]		
White blood cell count (k/mm^3)		7.5 ± 2	7.1 ± 1.6	0.30
Neutrophil count (k/mm^3)		4.5 ± 1.6	4.3 ± 1.3	0.28
Red cell distribution width (%)		15.5 ± 1.7	14.4 ± 1.2	**0.001**
Platelet count (k/mm^3)		255 ± 84	256 ± 49	0.95

[a]Mann–Whitney *U* test.
[b]Independent sample *t*-test.

processes with proinflammatory molecules they secrete [11]. The surrogate marker of platelet activation and production is the mean platelet volume (MPV). Various studies have shown a relationship between the MPV and inflammatory diseases [12–14]. Another inflammatory marker derived from a routine blood count test is the neutrophil to lymphocyte ratio (NLCR). NLCR has been reported as a predictive marker of outcomes in patients treated for various cancers, such as, colorectal adenocarcinoma [2], renal cancer [4], hepatocellular carcinoma (HCC) [15], cancer of esophagogastric junction [16], and lung cancer [17]. In a recent study, the preoperative NLCR corresponded to glial brain tumor grading [18].

In the present retrospective study, these simple inflammatory markers were evaluated in patients with brain tumors and compared with those in the healthy population. These laboratory parameters were also compared within brain tumors of either metastatic or primary etiology, as the radiological imaging of brain masses usually cannot differentiate metastatic or primary tumors [19–21].

2. Material and methods

2.1. Subjects

The use of the data in this retrospective study was approved by our hospital. Patients with brain tumor visited outpatient clinics of our institution were enrolled to the study as study group. Both primary and metastatic newly diagnosed brain tumor cases that not received any treatment were included to the study. None of the participants in study group were receiving medications that may probably affect hemogram parameters. Hemogram of the tumor patients have been obtained at the time of diagnosis before administration of corticosteroid therapy. The control group was selected from patients who visited the hospital's out patient clinics for routine checkups. Of the 48 brain tumor patients, 28 had primary brain tumors, and 20 had metastatic tumors. For the 28 primary tumor patients, 20 had glioblastoma multiforme (grade 4), 6 had anaplastic astrocytoma (grade 3), and 2 had diffuse astrocytoma (grade 2). The control group was selected from patients who visited the hospital's outpatient clinics for routine checkups. None of the subjects in the study and control groups had a history of chronic use of maintenance medicines. The characteristics and laboratory data of the study population are summarized in Tables 1 and 2. No significant difference was seen between the study and control groups in terms of age ($p = 0.38$) or gender ($p = 0.83$).

2.2. Blood panel

The laboratory data of the brain tumor patients were recorded before surgery from database of our institution. The white blood cell count (WBC), neutrophil count (neu), lymphocyte count (lym), hemoglobin (Hb), hematocrit (Htc), RDW, platelet count (PLT), and MPV of the participants were obtained from the hospital's medical database. Venous blood samples were collected in sterile standard tubes containing constant amounts of ethylene diamine tetraacetic acid as an anticoagulant. The laboratory assessment was conducted within several minutes after the blood samples were obtained. The LH 780 automatic analyzer (Beckman Coulter, Inc., Brea, CA, USA) was used for complete blood count analyses. Original kits of the producer were used in these measurements.

2.3. Statistical analysis

All data recorded were assessed with SPSS software (SPSS 15.0; SPSS Inc., Chicago, IL, USA). The independent samples *t*-test was used for normally distributed variables and the Mann–Whitney *U* test was used for non-homogeneously distributed parameters. The primary brain tumor, metastatic brain tumor, and control groups were compared with an ANOVA test. The results of the statistics were expressed as either mean ± SD or median (min–max). Statistical significance was set as p value of lower than 0.05.

3. Results

This retrospective study examined 48 patients with brain tumors (primary and metastatic) and 48 healthy control