

Platelet indices in patients with colorectal cancer

Research Article

Bülent Karagöz^{1*}, İlker Sücüllü², Özkan Sayan³, Oğuz Bilgi¹, Tolga Tuncel¹,
Ali İlker Filiz², Ergün Yücel², Alpaslan Oztun¹, Alev Akyol Erikçi³,
Ahmet Alacacioğlu¹, Emin Gokhan Kandemir¹

¹ GATA Haydarpaşa Training Hospital, Department of Medical Oncology,
34668 Haydarpaşa, İstanbul, Turkey

² GATA Haydarpaşa Training Hospital, Department of General Surgery,
34668 Haydarpaşa, İstanbul, Turkey

³ GATA Haydarpaşa Training Hospital, Department of Hematology,
34668 Haydarpaşa, İstanbul, Turkey

Received 13 March 2009; Accepted 30 May 2009

Abstract: The interaction between cancer cells and platelets has been known for a long time. Although platelet indices have been also investigated in several clinical settings, it has not been exactly demonstrated in cancer patients. We investigated platelet indices in colorectal cancer patients and compared with healthy subjects. Two hundred and twenty-one colorectal cancer patients and 110 healthy subjects were enrolled into the retrospective study. Data were obtained from computerized medical records of our hospital. Medical record review was performed for all patients regarding thrombocyte indices. Platelet count ($325.000/\text{mm}^3 \pm 265.000/\text{mm}^3$ vs $267.000/\text{mm}^3 \pm 67.000/\text{mm}^3$; $p=0.025$; respectively) and plateletcrit (Pct) ($0.25\% \pm 0.10$ vs 0.21 ± 0.05 ; $p<0.001$; respectively) were increased in patients compared with healthy subjects while mean platelet volume (MPV) and platelet distribution width (PDW) were similar. The platelet indices were not related to existence of metastasis or acute abdomen. Platelet count and Pct, but not MPV and PDW, are elevated in colorectal cancer patients. Future studies that investigate platelet morphology, function, and putative role of platelets in tumorigenesis and metastasis should be established.

Keywords: Colorectal carcinoma • Mean platelet volume • Platelet indices

© Versita Sp. z o.o.

1. Introduction

The interaction between cancer cells and platelets has been known for a long time. In cancer patients, platelet activation and thromboembolic events frequently occur [1-3]. Thrombocytosis is also observed in patients with cancer including colorectal cancer and elevated platelet count is associated with poor survival [4-6]. Platelets are also considered to play a role in metastasis. Aksoy et al. [7] investigated mean platelet volume (MPV) values in the diagnosis of bone marrow metastasis in patients with solid tumors and they found that the mean MPV in patients with marrow metastasis is lower than in patients without metastasis. We previously found that thrombocytosis is a prognostic factor in stage II colon cancer [8].

The platelet indices have been also investigated in several clinical settings. Mean platelet volume (MPV) is found to be a risk factor for myocardial infarction [9-11]. It is also reported in several studies that MPV values are higher in patients with diabetes mellitus [12-14]. Platelet distribution width (PDW) is an indicator of variation in platelet size, which can be a sign of active platelet release. It has been demonstrated that PDW and MPV are also altered in several conditions [15,16]. These platelet parameters have not been studied overall in cancer patients.

We investigated the variation of platelet indices in colorectal cancer patients and compared them with healthy subjects.

* E-mail: bulentkaragoz1968@yahoo.com

2. Material and Methods

In this retrospective study, 221 colorectal cancer patients (Patient group) and 110 healthy subjects (Control group) were enrolled. The mean ages of the groups were identical. Pretreated (before chemotherapy, radiotherapy, or tumor surgery) hematological parameters were collected. Data from patients and healthy subjects from nursing homes of hospitals or check-up centers (healthy control) were obtained from the computer-based patient record of our hospital. An automated blood counter (Coulter Gen-S, Minnesota, MN, USA) had been used for complete blood count (CBC). Patients who did not have their CBC performed by this analyzer were excluded. Patient's age, gender, diagnosis, stage, platelet count, plateletcrit (Pct), PDW and MPV values were documented. Data were analyzed with SPSS software. Student T test and Chi square test were used for comparing groups.

3. Results

Eighty-five cases of the patient group were female (38.5%), while thirty-eight of healthy subjects were female (34.5%). Fifty-four of the colorectal cancer patients (24.4%) had metastasis. Thirty-three patients (14.9%) were admitted with acute abdomen due to perforation or ileus as initial presentation. The characteristics of patients and healthy subjects are shown in Table 1.

With respect to hematological parameters, white blood cells (WBC) were decreased in colorectal cancer patients compared with healthy subjects. The parameters of red blood cells in the patient group were lower than that of the control group. Platelet count and Pct were increased in patients, while MPV and PDW were not different (Table 2). Forty-one colorectal cancer patients (18.6%) and only 6 healthy subjects (5.5%) had high platelet count ($\geq 400.000/\text{mm}^3$) ($p=0.01$).

Table 1. The characteristics of patients and healthy subjects.

	Patients	Controls
Age		
Median	70	76.5
Range	20-90	22-95
Gender		
Male	136 (61.5%)	72 (65.5%)
Female	85 (38.5%)	38 (34.5%)
Stage		
I	29	
II	75	
III	63	
IV	54	
Acute abdomen (in first presentation)	33 (14.9%)	
Tumor localization		
Ascending colon	37	
Transverse colon	14	
Descending colon	50	
Rectum	109	
Undetermined	9	

The platelet indices were not different in metastatic colorectal cancer patients when compared with those without metastasis. These indices were also similar in patients who presented with and without acute abdomen (Table 3). These platelet parameters were not different among stages and among tumor localizations (Data have not been shown).

4. Discussion

We aimed to compare platelet indices in colorectal cancer patients with healthy subjects in this study. We found that platelet count and Pct are higher in patients than in healthy subjects while MPV and PDW are similar. There are limitations in this study. First, morphology and functional tests of platelets were not studied. Second,

Table 2. Hematological perimeters in patients and healthy subjects.

		Patients	Controls	p
White blood cells	/mm ³	8990 ± 5090	7000 ± 1490	<0.001
Red blood cells	10 ⁶ /mm ³	4,31 ± 0,95	4,51 ± 0,50	0,049
Hemoglobin	gr/dL	11,72 ± 1,94	13,46 ± 1,60	<0.001
Hematocrit	%	35,61 ± 5,52	39,66 ± 4,75	<0.001
Mean corpuscular volume	fL	83,36 ± 9,79	88,36 ± 5,61	<0.001
Platelet count	x1000/mm ³	325 ± 265	267 ± 67	0,025
Plateletcrit	%	0,25 ± 0,10	0,21 ± 0,05	<0.001
Mean platelet volume	fL	8,49 ± 4,34	8,07 ± 0,91	0,325
Platelet distribution width	%	16,16 ± 0,77	16,12 ± 0,84	0,664

Table 3. Platelet indices in the patient group.

	With acute abdomen	Without acute abdomen
n	33	188
Platelet count	380 ± 636	315 ± 113
Plateletcrit	0,24 ± 0,10	0,25 ± 0,10
Mean palatetelet volume	8,62 ± 0,95	8,46 ± 4,70
Platelet distribution width	16,27 ± 0,74	16,14 ± 0,77
	Metastatic disease	Non-metastatic disease
n	53	133
Platelet count	291 ± 104	336 ± 298
Plateletcrit	0,24 ± 0,13	0,25 ± 0,09
Mean palatetelet volume	8,30 ± 1,17	8,55 ± 4,94
Platelet distribution width	16,29 ± 0,90	16,11 ± 0,72

All p values are higher than 0.05

survival data analysis was not done. Lastly, the study should be conducted prospectively for better results.

We previously evaluated whether or not thrombocytosis is a prognostic factor in stage II colon cancer [8]. Out of 198 patients, 24 (12.1%) had thrombocytosis, and its presence correlated with tumour depth and lymphatic invasion. The disease-free survival and overall survival were shorter in patients with thrombocytosis than in node-negative colon cancer patients. Pedersen et al. [4] investigated thrombocytosis in 1115 lung cancer patients and found the prevalence of thrombocytosis to be 32%. This percentage was higher than in control subjects. Patients with thrombocytosis had a significantly poorer survival rate than those with normal platelet counts. In our study, 41 colorectal cancer patients had higher platelet counts (>400.000 per microliter), but survival analysis was not performed.

Aksoy S et al. [7] investigated MPV value in the diagnosis of bone marrow metastasis in solid tumor patients and they found that mean MPV in patients with

marrow metastasis is lower than in patients without metastasis. We did not find any difference between metastatic and non-metastatic disease.

Microvessel density and platelet count were increased in NSCLC patients and both are prognostic in follow up [5]. Platelets release angiogenic growth factors and adhere to tumor microvessels. Platelet extravasation occurs into the extracellular matrix via increased vascular permeability. This process leads to platelet activation. MPV and PDW are indicators of platelet activation and size variation. However, we did not find any difference regarding MPV and PDW between patients and healthy subjects.

In conclusion, MPV and PDW are not altered but platelet count and Pct are elevated in colorectal cancer patients. These platelet parameters are not related with stage or acute abdomen as presenting signs. Future studies that investigate platelet morphology, function, and putative role of platelets in tumorigenesis and metatasis should be established.

References

- [1] Sun N.C., McAfee W.M., Hum G.J., Weiner J.M. Hemostatic abnormalities in malignancy, a prospective study of one hundred eight patients. Part I. Coagulation studies, *Am. J. Clin. Pathol.*, 1979, 71, 10-16
- [2] Rickles F.R., Levine M., Edwards R.L. Hemostatic alterations in cancer patients, *Cancer Metastasis Rev.*, 1992, 11, 237-248
- [3] Miller S.P., Sanchez-Avalos J., Stefanski T., Zuckerman L. Coagulation disorders in cancer. I. Clinical and laboratory studies, *Cancer*, 1967, 20, 1452-1465
- [4] Pedersen L.M., Milman N. Prognostic significance of thrombocytosis in patients with primary lung cancer, *Eur. Respir. J.*, 1996, 9, 1826-1830
- [5] Cox G., Walker R.A., Andi A., Steward W.P., O'Byrne K.J. Prognostic significance of platelet and microvessel counts in operable non-small cell lung cancer, *Lung Cancer*, 2000, 29, 169-177
- [6] Schwarz R.E. Platelet counts and prognosis of pancreatic cancer, *Lancet*, 1999, 353, 2158-2159
- [7] Aksoy S., Kilickap S., Hayran M., Harputluoglu H., Koca E., Dede D. S., Erman M., Turker A. Platelet size has diagnostic predictive value for bone marrow metastasis in patients with solid tumors, *Int. J. Lab. Hematol.*, 2008, 30, 214-219
- [8] Kandemir E.G., Mayadagli A., Karagoz B., Bilgi O., Turken O., Yaylaci M. Prognostic significance of

- thrombocytosis in node-negative colon cancer, *J. Int. Med. Res.*, 2005, 33, 228-235
- [9] Huczek Z., Kochman J., Filipiak K.J., Horszczaruk G. J., Grabowski M., Piatkowski R., Wilczynska J., Zielinski A., Meier B., Opolski G. Mean platelet volume on admission predicts impaired reperfusion and long-term mortality in acute myocardial infarction treated with primary percutaneous coronary intervention, *J. Am. Coll. Cardiol.*, 2005, 46, 284-290
- [10] Duygu H., Turkoglu C., Kirilmaz B., Turk U. Effect of mean platelet volume on postintervention coronary blood flow in patients with chronic stable angina pectoris, *J. Invasive Cardiol.*, 2008, 20, 120-124
- [11] Endler G., Klimesch A., Sunder-Plassmann H., Schillinger M., Exner M., Mannhalter C., Jordanova N., Christ G., Thalhammer R., Huber K., Sunder-Plassmann R. Mean platelet volume is an independent risk factor for myocardial infarction but not for coronary artery disease, *Br. J. Haematol.*, 2002, 117, 399-404
- [12] Saigo K., Yasunaga M., Ryo R., Yamaguchi N. Mean platelet volume in diabetics, *Rinsho Byori*, 1992, 40, 215-217
- [13] Sharpe P.C., Trinick T. Mean platelet volume in diabetes mellitus, *Q. J. Med.*, 1993, 86, 739-742
- [14] Hekimsoy Z., Payzin B., Ornek T., Kandogan G. Mean platelet volume in Type 2 diabetic patients, *J. Diabetes Complications*, 2004, 18, 173-176
- [15] Osselaer J.C., Jamart J., Scheiff J.M. Platelet distribution width for differential diagnosis of thrombocytosis, *Clin. Chem.*, 1997, 43, 1072-1076
- [16] Amin M.A., Amin A.P., Kulkarni H.R. Platelet distribution width (PDW) is increased in vaso-occlusive crisis in sickle cell disease, *Ann. Hematol.*, 2004, 83, 331-335