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Dermatoglyphs and Gastric Cancer

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A B S T R A C T

Gastric cancer is very common malignant disease, etiology of which is still unknown. Some studies consider that it is caused by a joint activity of both genetic and environmental factors. Digito-palmar dermatoglyphs were already used to determine hereditary base of some malignant diseases (breast, lung and colorectal cancer) and it was the reason for investigations of the correlation of their quantity features at patients with gastric cancer (36 males and 32 females) and the control groups of phenotypically healthy persons (50 males and 50 females). By performing statistical data processing of the multivariate and univariate analysis, as well as of discriminant ones, it was possible to prove the existence of heterogeneity between the investigated groups. Higher incidence of gastric cancer and the blood group A could be confirmed, as well. From the obtained findings can be concluded, that the results of quantitative analysis of digito-palmar dermatoglyphs affirm the existence of genetic predisposition for development of gastric cancer.

***Key words**: dermatoglyphs, gastric cancer, blood groups, genetic predisposition.*

Introduction

Gastric cancer is rather common malignancy in general and the most common malignancy of the alimentary bowel, although its incidence has been falling during the last 50 years[1]. This disease has some very interesting epidemiological characteristics. The incidence varies throughout the world, but there are also high-incidence and low-incidence areas within the same country. Japan has the highest incidence (78/100,000), and the USA has the lowest one (6/100,000)[2]. Croatia is considered to be one of the high-incidence countries, where gastric cancer takes the second place in male (25/100,000) and the third one in female (11/100,000) population. The northern parts of the country have higher incidence than the southern ones[3,4].

Patho-histologically, 90–95% of gastric cancers are adenocarcinomas, located mostly in the antro-pylorical region (50–60%)[5]. There are many classifications of

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this disease, but prognostically the most important one divides it into the early-type, limited to the upper layers, mucosis and submucosis, and the advanced-type, that has penetrated the muscularis propria and beyond[6,7]. Those two types significantly differ in prognosis – the five-year survival rate for early-type of gastric cancer[8] is 93–95% and for the advanced-type is 5–15%. It is considered that it takes eight years for early-type to become advanced one, but because of the nonspecific symptomatology, gastric cancer in this early stage can be very rarely diagnosed, only 10% in the USA and 35% in Japan[9].

The etiology of gastric cancer, as well as the etiology of other malignant diseases still remains unclear, but both genetic and environmental factors seem to be important[10,11]. Gastric cancer is a family disease in about 10% of the cases, where the incidence between relatives is almost four times higher[12–14]. In 25% of the cases of heritable gastric cancer, truncating mutations in the E-cadherin gene (CDH1) are identified as predisposing factors. This mutation is inherited as an autosomal dominant trait with 60–80% penetrance. In those cases the disease usually appears before the age of 30 and has bad prognosis[15]. The important role in gastric carcinogenesis seem to have the accumulation of c-myc[16], bcl-2[17,18], c-K-ras[19] and p-53[20,21] mutations[22] as well as the loss of allele[23].

On the other side, the study of gastric cancer incidence among Japanese immigrants to the USA points out the role of the environmental factors. The incidence in the first generation was the same as the one in Japan, but it decreased in the second one and in the third one it was already the same as in the USA. It means that some environmental factors in Japan are not present in the USA. The most important environmental factor is food, containing a carcinogen or being converted into one either during preparation and preservation or in the stomach after ingestion[24,25]. Established carcinogens are nitrozamines[26,27]. Some importance show also 3,4-benzopyrene, salt, alcohol and smoking[28–30], while vitamins C, A, E, organosulphoric compounds in onion, fitochemicyns, flavonoids in tea and cereal fiber seem to have protective role[31,32].

The Helicobacter pylori is also established carcinogen and this infection increases about 5 times the risk of can-cer [33–35].

The incidence of the blood group A among gastric cancer patients seems to be the most common one[2].

Dermatoglyphs are patterns made by epidermis on fingers, palms and soles. They are completely formed by 21st week of the intrauterine development and furthermore, totally resistant to any external factor, remaining unchanged until the end of a person's life. These are highly hereditary characteristics, although the exact way of inheritance is still unknown and strongly individual, because there are not two persons in the world with the same dermatoglyphics[36–37]. Therefore, studying of dermatoglyphs contributes to our better understanding of genetic status and early intrauterine development and it makes them applicable in biomedical sciences[38].

The aim of this study is to test the hypothesis of genetic predisposition for gastric cancer. The necessary for the development of the gastrointestinal tract and for development of the dermatoglyphs is the same and the disturbances in embryological life could have influences on development of the cancer, but they could also have reflection on dermatoglyphic patterns. This reflection can be tested using the comparative analysis of dermatoglyphs of the digito-palmar complex in groups of gastric cancer patients and the healthy controls.

Materials and Methods

We investigated digito-palmar dermatoglyphs of 68 patients (36 male and 32 female), who have had patho-histological diagnosis »adenocarcinoma ventriculi«. Comparative group was made of 100 phenotypically healthy inhabitants of the town of Sisak (50 males and 50 females) who have never had any malignant disease. The digito-palmar prints were taken and analyzed according to the Cummins and Midlo[39] methods, and some pieces of advice were taken from the book Miličić et al.[40].

The analysis comprised a total of 18 quantitative variables of digito-palmar dermatoglyphics (finger ridge-counts on the right and the left hand: FRR1, FRR2, FRR3, FRR4, FRR5, FRL1, FRL2, FRL3, FRL4, FRL5; palmar ridge-counts on the right and on the left hand: a-b rc R, b-c rc R, c-d rc R, a-b rc L, b-c rc L, c-d rc L and the atd angles (atdR and atdL). The quantitative traits of digito-palmar dermatoglyphs were analyzed by using descriptive statistics, multivariate and univariate variance analysis and discriminant analysis.

Results

The results of descriptive statistics comparing 18 quantitative variables of digito-palmar dermatoglyphs from gastric cancer patient groups (male and female) and their control groups are presented on Table 1 in males and Table 2 in females.

Multivariate analysis of variance (Table 3) enabled throwing off the hypothesis

TABLE 1
DESCRIPTIVE STATISTICS FOR QUANTITATIVE DIGITO-PALMAR DERMATOGLYPHIC TRAITS IN THE GROUP OF MALE PATIENTS SUFFERING FROM GASTRIC CANCER (N = 36) AND HEALTHY CONTROL MALES (N = 50)

	Gastric cancer		Healthy control	
Variables	X	SD	X	SD
FRR 1	19.44	6.05	18.92	4.89
FRR 2	12.50	7.19	12.32	6.17
FRR 3	14.08	7.01	12.10	5.07
FRR 4	16.89	4.84	14.94	5.92
FRR 5	14.31	4.57	13.48	4.76
a-b rc R	35.20	5.25	38.82	6.03
b-c rc R	23.09	4.78	25.48	4.93
c-d rc R	31.57	5.19	35.22	6.52
atd R	40.91	5.72	42.76	5.90
FRL 1	17.19	5.92	16.12	4.78
FRL 2	12.22	5.77	10.80	5.95
FRL 3	14.06	7.01	12.34	4.74
FRL 4	16.83	5.70	14.94	4.57
FRL 5	13.53	3.99	12.62	4.78
a-b rc L	35.40	5.60	39.32	6.35
b-c rc L	23.83	3.84	25.02	5.53
c-d rc L	30.14	5.73	33.90	5.18
atd L	40.00	4.52	43.10	5.75

TABLE 2
DESCRIPTIVE STATISTICS FOR QUANTITATIVE DIGITO-PALMAR DERMATOGLYPHIC TRAITS IN THE GROUP OF FEMALE PATIENTS SUFFERING FROM GASTRIC CANCER (N = 32) AND HEALTHY CONTROL FEMALES (N = 50)

	Gastric cancer		Healthy control	
Variables	X	SD	X	SD
FRR 1	16.19	6.76	17.22	4.85
FRR 2	9.84	6.84	11.42	5.54
FRR 3	11.66	6.67	11.34	4.98
FRR 4	16.06	5.99	14.68	5.36
FRR 5	12.19	5.65	12.30	5.31
a-b rc R	34.06	5.07	36.58	5.54
b-c rc R	21.59	4.12	24.72	4.67
c-d rc R	30.88	5.37	33.96	6.12
atd R	41.78	6.36	44.22	8.19
FRL 1	13.81	5.28	14.64	4.80
FRL 2	9.16	6.52	10.20	5.90
FRL 3	10.94	6.89	12.16	5.25
FRL 4	14.38	7.09	14.36	4.65
FRL 5	11.44	5.84	11.82	4.88
a-b rc L	35.97	5.94	37.90	5.08
b-c rc L	20.47	4.53	24.44	4.97
c-d rc L	29.84	3.91	32.40	7.19
atd L	44.69	6.98	43.88	7.08

of homogeneity of investigated variables between the groups we studied with $p< 0.045$ in males and $p<0.046$ in females. The univariate analysis of variance enabled the identification of variables, making the greatest contribution to this heterogeneity between the investigated groups: in males: a-b rc R ($p<0.005$), b-c rc R ($p<0.05$), c-d rc R ($p<0.01$), a-b rc L ($p< 0.005$), c-d rc L ($p<0.005$) and atd L ($p< 0.01$) and in females: a-b rc R ($p<0.005$), b-c rc R ($p<0.005$), c-d rc R ($p<0.05$) and b-c rc L ($p<0.005$).

We also analyzed the differences between investigated groups using canonical discriminant analysis (Table 4). The canonical discriminant analysis provided correct classification in 76.5% of male examinees (74.3% with gastric cancer and 78% healthy controls), while in females 76.8% examinees were correctly classified (78.1% with gastric cancer and 76% healthy controls).

We have also confirmed the statement that gastric cancer is 1.2 times more often in blood group A, than in blood group 0[2]. From 62 examinees that checked their blood group, 23 had blood-group A and 19 had blood group 0 (23/19 = 1.2). This correlation in healthy persons was different. From 75 examinees with known blood-group 26 blood-group A and 35 of them had blood-group 0 (26/35 = 0.74).

Discussion

Gastric cancer is common malignancy in general and the most common malignancy of the alimentary bowel. Despite of the fall of the incidence in the last 50

TABLE 3
MULTIVARIATE AND UNIVARIATE ANALYSES OF VARIANCE FOR THE QUANTITATIVE DIGITO-PALMAR DERMATOGLYPHIC TRAITS BETWEEN PATIENTS SUFFERING FROM GASTRIC CANCER AND HEALTHY CONTROL MALES AND FEMALES

	Multivariate analysis	
Male	F = 0.656 df = 18 p<0.045	
Female	F = 0.661 df = 18 p<0.046	
	Univariate analysis (F)	
Variables	Males	Females
FRR 1	0.109	0.648
FRR 2	0.005	1.311
FRR 3	2.196	0.061
FRR 4	2.404	1.184
FRR 5	0.899	0.008
a-b rc R	8.236***	4.294***
b-c rc R	4.975*	9.560***
c-d rc R	7.590**	5.439*
atd R	2.069	2.044
FRL 1	0.611	0.536
FRL 2	0.982	0.563
FRL 3	1.849	0.827
FRL 4	2.904	0.001
FRL 5	0.756	0.103
a-b rc L	8.623***	2.468
b-c rc L	1.214	13.319***
c-d rc L	9.932***	3.395
atd L	7.083**	0.256

* p<0.05 ** p<0.01*** p<0.005

years, it is still a great medical problem and frequent cause of death throughout the world. Croatia is considered to be one of the high-incidence countries where gastric cancer takes a second place in male and a third in female population groups.

The etiology of gastric cancer still remains unclear, but both the environmental and the genetic factors seem to be important. Diet and Helicobacter pylori infection are considered to be the most important among the environmental factors. The genetic factors are the issue of many investigations.

Many authors successfully applied dermatoglyphics of digito-palmar complex to estimate the hereditary base of some common malignant diseases: Basauri et al.[40] and Croat authors Rudan et al.[41] Miličić et al.[42] studied quantitative traits of breast cancer, leiomyomas and fibromyomas uteri, cervical cancer, colorectal cancer and cancer of the thyroid gland, Miličić et Pavićević[43] examined dermatoglyphics of digito-palmar complex in four types of bronchopulmonary carcinoma. All the authors found differences, especially in palmar dermatoglyphics, between the group of patients suffering from different type of carcinomas and healthy control groups. They concluded, that gene instability could be the basis for developing cancer late in life by the influence of environmental factors.

These studies encouraged us to investigate the quantitative traits in patients with gastric cancer and the control group of phenotypically healthy persons. Our results show statistically significant heterogeneity between the gastric cancer group and the control group at p<0.045 in males and p<0.046 in females. The univariate analysis of variance showed that palmar ridge counts were significantly lower in both sexes, while the canonical discriminant analysis showed the correct classification of 76.5% male and 76.8% female examinees, which was very high percentages.

Our results harmonize with the results of other studies of quantitative traits of digito-palmar dermatoglyphics of breast, cervical, bronchopulmonary and colorectal cancer. These studies also confirm the existence of heterogeneity between the examined groups, mostly as a result of palmar dermatoglyphic characteristics. With our study, we could prove that quantitative traits of digito-palmar dermatoglyphs separate the group of patients

TABLE 4
THE RESULTS OF DISCRIMINANT CLASSIFICATION BETWEEN THE GROUP OF PATIENTS SUFFERING FROM GASTRIC CANCER AND HEALTHY CONTROL MALES AND FEMALES

Males	N	Correctly classified	%	Incorrectly classified	%
Patients	36	26	74.3	9	25.7
Healthy controls	50	39	78.0	11	22.0
Total of correctly classified			76.5		
Females	**N**	**Correctly classified**	**%**	**Incorrectly classified**	**%**
Patients	32	25	78.1	9	21.9
Healthy controls	50	38	76.0	12	24.0
Total of correctly classified			76.8		

with gastric cancer from the control group of phenotypically healthy persons and therefore we can confirm the existence of genetic predisposition to gastric cancer.

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DERMATOGLIFI I KARCINOM ŽELUCA

S A Ž E T A K

Karcinom želuca je vrlo česta maligna bolest, čija je etiologija još uvijek nepoznata. Smatra se da nastaje zajedničkim djelovanjem genetskih čimbenika i čimbenika okoline. Digito-palmarni dermatoglifi su već primjenjivani u procjeni nasljedne osnove nekih malignih bolesti (karcinoma dojke, pluća, kolorektalnog karcinoma), što je bio povod za ispitivanje korelacije njihovih kvantitativnih svojstava kod oboljelih od karcinoma želuca (36 muškaraca i 32 žene) u odnosu na kontrolne skupine fenotipski zdravih osoba (50 muškaraca i 50 žena). Učinjenom statističkom obradom multivarijatnom i univarijatnom analizom varijance, te diskriminacijskom analizom dokazano je da se uspoređivane skupine značajno razlikuju. Potvrđeno je postojanje veće učestalosti raka želuca u bolesnika s krvnom grupom A. Iz dobivenih nalaza moguće je zaključiti da rezultati kvantitativne analize digito-palmarnih dermatoglifa kod oboljelih od karcinoma želuca potvrđuju postojanje genetske predispozicije za razvoj ove bolesti.