

Distribution of AB0 and Rh blood groups in cancer patients; is A Rh (+) blood group a risk factor in colorectal cancer development?

Kanser hastalarında AB0 ve Rh kan gruplarının dağılımı; A Rh (+) kan grubu kolorektal kanser gelişiminde bir risk faktörü müdür?

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SUMMARY



Objective: Genetic factors have been the subject of many studies in cancer etiology. One of the most striking of these is the relationship between blood groups and cancer. Therefore, in our study, we examined the relationship between blood groups of stomach, colorectal, breast, thyroid and pancreatic cancers, which are common in general surgery practice, with single-center data.

Method: We retrospectively analyzed cancer cases who applied to our University Hospital between 2005-2021. This analysis was done using a hospital database. 7899 cancer patients were included in the study. Cancer types, blood types, ages and gender of the patients were recorded. Results were analyzed statistically.

Results: 55.2% of the patients included in the study were male and 42.8% were female. Of the patients, 553 (7%) were stomach, 767 (9.7%) colorectal, 779 (9.9%) breast, 625 (55.15%) thyroid, 209 (2.6%) pancreatic cancer. 87.4% of the patients were Rh (+), 12.6% of them were Rh (-). 38% of patients A Rh (+), 5.2% A Rh (-), 13.8% B Rh (+), 2.2% B Rh (-), 7.7% AB Rh (+), 1.3% AB Rh (-), 28% 0 Rh (+), 3.8% 0 Rh (-). With the blood group distribution of all cancers; When the blood group distribution of gastric, colorectal, breast, thyroid and pancreatic cancers were compared, no statistically significant difference was found. However, it was found that the A Rh (+) blood group was higher in colorectal cancers compared to other cancers.

Conclusions: In our study, no relationship was found between all cancers and blood type. In addition, no relationship was found between blood type and stomach, colorectal, breast, thyroid and pancreatic cancers, which are common in general surgery practice. Although it is generally accepted that especially A blood group is a risk factor for gastric cancer, there was no significant difference in our patient series. When AB0 and Rh blood groups were evaluated together, the A Rh (+) blood group was seen more in colorectal cancers.

Keywords: AB0, blood group, cancer, RH.

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ÖZET

Amaç: Genetik faktörler kanser etiolojisinde birçok araştırmaya konu olmuştur. Bunların en çarpıcılarından biri kan grupları ile kanser arasındaki ilişkidir. Bu nedenle çalışmamızda genel cerrahi pratiğinde sık görülen mide, kolorektal, meme, tiroid ve pankreas kanserlerinin kan grupları arasındaki ilişkiyi tek merkezli verilerle inceledik.

Yöntem: Üniversite Hastanemize 2005-2021 yılları arasında başvuran kanser vakalarını retrospektif olarak inceledik. Bu analiz bir hastane veri tabanı kullanılarak yapıldı. 7899 kanser hastası çalışmaya dahil edildi. Hastaların kanser türleri, kan grupları, yaşları ve cinsiyetleri kaydedildi. Sonuçlar istatistiksel olarak analiz edildi.

Bulgular: Çalışmaya alınan hastaların %55.2'si erkek, %42.8'i kadındı. Hastaların 553'ü (%7) mide, 767'si (%9,7) kolorektal, 779'u (%9,9) meme, 625'i (%55,15) tiroid, 209'u (%2,6) pankreas kanseri idi. Hastaların %87.4'ü Rh (+), %12.6'sı Rh (-) idi. Hastaların %38'i A Rh (+), %5,2'si A Rh (-), %13,8'i B Rh (+), %2,2'si B Rh (-), %7,7'si AB Rh (+), %1,3'ü AB Rh (-), %28'i 0 Rh (+) ve %3.8'i 0 Rh (-)'di. Tüm kanserlerin kan grubu dağılımı ile; Mide, kolorektal, meme, tiroid ve pankreas kanserlerinin kan grubu dağılımları karşılaştırıldığında istatistiksel olarak anlamlı bir fark saptanmadı. Ancak kolorektal kanserlerde A Rh (+) kan grubunun diğer kanserlere göre daha yüksek olduğu tespit edildi.

Sonuç: Çalışmamızda tüm kanserler ile kan grubu arasında anlamlı bir ilişki tespit edilmedi. Ayrıca genel cerrahi pratiğinde sık görülen mide, kolorektal, meme, tiroid ve pankreas kanserleri ile kan grubu arasında bir ilişki görülmedi. Özellikle A kan grubunun mide kanseri için bir risk faktörü olduğu genel olarak kabul edilse de bizim hasta serimizde anlamlı bir ilişki görülmedi. AB0 ve Rh kan grupları birlikte değerlendirildiğinde kolorektal kanserlerde A Rh (+) kan grubu daha fazla görüldü.

Anahtar sözcükler: AB0, kanser, kan grubu, Rh.

INTRODUCTION

Blood group research has advanced significantly in recent years. AB0 and Rh blood groups are the most important among human blood group systems^{1,2}. Small carbohydrate epitopes characterize blood types due to the presence of "A" and "B" genes located on chromosome 9q34³. Many studies have discussed the role of AB0 blood types as a prognostic biomarker in different types of cancer⁴. In particular, many studies are showing the relationship of the AB0 blood group system with gastric⁵ and pancreatic cancers^{6,7}, as well as inconsistent results in some types of cancer such as breast cancer⁸. It is a biological fact that the clinical significance of AB0 blood groups may extend beyond immunohematological, transfusion and transplantation medicine. There is increasing evidence in the literature that the AB0 blood group system plays an important role in the development of cardiovascular, infectious and neoplastic diseases as well as some other diseases^{9,10}. More specifically, although a number of studies have found evidence of an association between AB0 blood group antigens and various types of cancer, so far the prognostic value in cancer patients has not been demonstrated^{11,12}. In addition, although different hypotheses have been made about the relationships between different cancer types and blood groups, the underlying molecular mechanisms are largely unknown.

In our study, in addition to age and gender characteristics of gastric, colorectal, breast, thyroid and pancreatic cancers, which are 5 common types of cancer in general surgery practice, their

relationships with AB0 and Rh blood groups were examined.

MATERIAL AND METHODS

Our study was conducted after the approval of the local ethics committee and the institutional review permission of Sivas Cumhuriyet University Health Services Application and Research Hospital. Within the scope of the study, archive information of all patients who applied to our university hospital with a diagnosis of cancer between 2005-2021 were accessed. The current cancer types, gender, age and AB0-Rh blood group characteristics of the patients were recorded. All cancer data were compared statistically with the data of stomach, colorectal, breast, thyroid and pancreatic cancers. In addition, all these data were compared with the population cross-sectional data in previous studies.

Statistical Analysis: The statistical analysis of the obtained data was performed using the SPSS 23.0 (SPSS Inc., Chicago, IL, USA) program. Kolgomogro-Smirnow test was used for normal distribution. Student T-test was used to compare non-normally distributed parameters, and Mann-Whitney U Test was used for normally distributed parameters. Chi-square test was used to compare categorical variables. The significance level was accepted as 0.05.

RESULTS

All Cancers: 7899 patients diagnosed with cancer, whose blood type information was available, were identified. The average age of the errors was 63.31. 4361 (55.2%) of these patients were male and 3538

(44.8%) were female (Table 1). There is a significant relationship between cancer and gender ($p = 0.0001$). Of the patients, 553 (7%) had stomach, 767 (9.7%) colorectal, 779 (9.9%) breast, 625 (55.15%) thyroid, 209 (2%) pancreatic cancer (Table 2).

6903 (87.4%) of the patients are Rh (+), 996 (12.6%) of them are Rh (-). Of the 4361 male cancer patients, 3813 (87.4%) were Rh (+), 546 (12.6%) were Rh (-). Of the 3538 female cancer patients, 3098 (87.5%) were Rh (+), 440 (12.4%) were Rh (-) (Table 3). No difference was found between genders in terms of Rh ($p=0.727$). The most common blood type was A Rh (+) in 3002 (38%) of the patients, while the least common blood type was AB Rh (-) in 100 (1.3%) of the patients. When looking at blood groups according

to gender; While A Rh (+) was the most common in 1632 (37.4%) of 4361 male patients, AB Rh (-) was the least common blood type in 62 male patients (1.4%). While A Rh (+) was found most frequently in 1370 (38.7%) of 3538 female patients, AB Rh (-) blood type was found to be the least common blood type in 38 (1.1%) female patients (Table 4). Although A blood group was the most common among blood groups, there was no significant relationship between blood group and cancer ($p=0.438$). No significant relationship was observed between gender and blood type in cancer patients ($p=0.307$). 106 of the patients (1.3%) were in the 0-20 age range, 538 (6.8%) in the 20-39 age range, 2098 (26.6%) in the 40-59 age range, 4109 (52%) are between 60-79 years old and 1048 (13.3%) are over 80 years old (Table 5).

Table 1: Cancer sex distribution

	All Cancer		Gastric		Colorectal		Brest		Thyroid		Pancreas	
	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%
Male	4361	55,2	367	66,4	461	60,1	8	1,0	125	20,0	120	57,4
Female	3538	44,8	186	33,6	306	39,9	771	99,0	500	80,0	89	42,6
Total	7899	100,0	553	100,0	767	100,0	779	100,0	625	100,0	209	100,0

Table 2: Cancer distribution and mean age

Cancer Type	Cases	%	Age
Gastric cancer	553	7	67,87
Colorectal Cancer	767	9,7	65,95
Breast cancer	779	9,9	58,77
Thyroid Cancer	625	7,9	55,15
Pancreatic Cancer	209	2,6	67,43
All Cancers	7899	100	63,31

Table 3: Cancer Rh incidence

Blood Groups	All Cancer		Male Cancer		Female Cancer		Gastric		Colorectal		Brest		Thyroid		Pancreas	
	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%
Rh (+)	6903	87,4	3813	87,4	3098	87,5	479	86,6	652	85	685	87,9	555	88,8	182	87,1
Rh (-)	996	12,6	546	12,6	440	12,4	74	13,4	115	15	94	12,1	70	11,2	27	12,9
Total	7899	100	4361	100,0	3538	100,0	553	100,0	767	100,0	779	100,0	625	100,0	209	100,0

Table 4: Cancer ABO and Rh incidence

		A Rh (+)	A Rh (-)	B Rh (+)	B Rh (-)	AB Rh (+)	AB Rh (-)	O Rh (+)	O Rh (-)	Total	P
Total Cancer	Cases	3002	414	1089	177	608	100	2212	297	7899	p=0.438
	%	38	5,2	13,8	2,2	7,7	1,3	28	3,8	100	
Male Cancer	Cases	1632	216	607	109	332	62	1242	161	4361	p=0.307
	%	37,4	5	13,9	2,5	7,6	1,4	28,5	3,7	100	
Female Cancer	Cases	1370	198	482	68	276	38	970	136	3538	
	%	38,7	5,6	13,6	1,9	7,8	1,1	27,4	3,8	100	
Gastric Cancer	Cases	208	32	82	10	48	11	141	21	553	p=0,556
	%	37,6	5,8	14,8	1,8	8,7	2	25,5	3,8	100	
Colorectal Cancer	Cases	311	49	85	30	61	10	195	26	767	p=0,004*
	%	40,5	6,4	11,1	3,9	8	1,3	25,4	3,4	100	
Brest Cancer	Cases	296	46	118	10	50	8	221	30	779	p=0,355
	%	38	5,9	15,1	1,3	6,4	1	28,4	3,9	100	
Thyroid Cancer	Cases	245	23	79	12	49	9	182	26	625	p=0,643
	%	39,2	3,7	12,6	1,9	7,8	1,4	29,1	4,2	100	
Pancreas Cancer	Cases	79	9	35	5	12	2	56	11	209	p=0,735
	%	37,8	4,3	16,7	2,4	5,7	1	26,8	5,3	100	

*p<0.05

Table 5: Cancer age group distribution

Age	All Cancers		Gastric		Colorectal		Brest		Thyroid		Pancreas	
	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%
0-20	106	1,3	15	2,7	15	2,0	51	6,5	2	0,3	1	0,5
20-39	538	6,8	114	20,6	205	26,7	352	45,2	101	16,2	49	23,4
40-59	2098	26,6	327	59,1	432	56,3	338	43,4	279	44,6	119	56,9
60-79	4109	52,0	97	17,5	115	15,0	38	4,9	210	33,6	40	19,1
80 +	1048	13,3	15	2,7	15	2,0	51	6,5	33	5,3	1	0,5
Total	7899	100	553	100,0	767	100,0	779	100,0	625	100,0	209	100,0

Stomach Cancers: 553 (7%) of 7899 cancer patients included in the study were gastric cancer. The average age of the patients is 67.87. 367 (66.4%) of the patients were male, 186 (33.6%) were female. 479 (86.6%) of the patients are Rh (+), 74 (13.4%) of them are Rh (-). While the most common blood type in gastric cancer patients was A Rh (+) in 208 patients (37.6%), the least common blood type was AB Rh (-) in 11 patients (2%). There was no significant relationship between blood group distribution of all cancers and gastric cancer blood group distribution ($p = 0.556$). 15 (2.7%) of the patients were in the 0-20 age range, 114 (20.6%) in the 20-39 age range, 327 (59.1%) in the 40-59 age range, 97 (17.5%) are between 60-79 years old and 15 (2.7%) are over 80 years old.

Colorectal Cancers: Colorectal cancer was detected in 767 (9.7%) of 7899 cancer patients included in the study. The average age of the patients was 65.95. 461 (60.1%) of the patients were male and 306 (39.9%) were female. 652 (85%) of the patients were Rh (+), 115 (15%) were Rh (-). While A Rh (+) was the most common blood type in 311 (40.5%) of the patients with colorectal cancer, AB Rh (-) was found to be the least common blood type in 10 (1.3%) of the patients. When the ABO blood group distribution of all cancers and colorectal cancers were compared, no statistically significant difference was found ($p = 0.093$). However, when ABO and Rh groups were evaluated together, we found that the most common A Rh (+) blood group was seen in colorectal cancers. We found that the A Rh (+) blood group was statistically significantly higher in

colorectal cancers when compared with all cancers ($p = 0.004$). 15 (2%) of the patients were in the 0-20 age range, 205 (26.7%) in the 20-39 age range, 432 (56.3%) in the 40-59 age range, 115 (15%) in the) 60-79 years old, 15 of them (2%) are over 80 years old.

Breast Cancers: Breast cancer was detected in 779 (9.9%) of 7899 cancer patients included in the study. The average age of the patients is 58.77. 8 (1%) of the patients were male, 771 (99%) were female. 685 (87.9%) of the patients were Rh (+), 94 (12.1%) were Rh (-). In 296 of the patients (38%), A Rh (+) was the most common blood type, while AB Rh (-) was found to be the least common blood type in 8 patients (1%). There was no significant difference between the blood group distribution of all cancers and breast cancer blood group distribution ($p = 0.355$). 51 of the patients (6.5%) were in the 0-20 age range, 352 (45.2%) in the 20-39 age range, 338 (43.4%) in the 40-59 age range, 38 (4.9%) are between 60-79 years old and 51 (6.5%) are over 80 years old.

Thyroid Cancers: Thyroid cancer was detected in 625 (7.9%) of 7899 cancer patients included in the study. The average age of the patients was 55.15. 125 (20%) of the patients were male and 500 (80%) were female. 555 (88.8%) of the patients were Rh (+), 70 (11.2%) were Rh (-). While A Rh (+) was the most common blood type in 245 (39.2%) of the patients, AB Rh (-) was the least common blood type in 9 (1.4%) of the patients. No significant relationship was found between the blood group distribution of all cancers and the blood group distribution of thyroid cancers ($p = 0.643$). 2 (0.3%) of the patients were in the 0-20 age range, 101 (16.2%) in the 20-39 age range, 279 (44.6%) in the 40-59 age range, 210 (33.6%) are between 60-79 years old and 33 (5.3%) are over 80 years old.

Pancreas Cancers: Pancreatic cancer was detected in 209 (2.6%) of 7899 cancer patients included in the study. The average age of the patients was 67.43. 120 (57.4%) of the patients were male, 89 (42.6%) were female. 182 of the patients (87.1%) were Rh (+), 27 (12.9%) were Rh (-). While A Rh (+) was the most common blood type in 79 (37.8%) of the patients, AB Rh (-) was found to be the least common blood type in 2 (1%) of the patients. There was no significant relationship between the blood group distribution of all cancers and the blood group distribution of pancreatic cancers ($p = 0.735$). One (0.5%) of the patients was in the 0-20 age range, 49 (23.4%) in the 20-39 age range, 119 (56.9%) in the 40-59 age range, 40 (19.1%) is between the ages of 60-79, and 1 (0.5%) is over 80 years old.

DISCUSSION

The discovery of AB0 blood groups and later RH antigens, which are considered to be a very meaningful invention in the hematological system, paved the way for serious studies in the scientific world. This groundbreaking invention was described by the Australian scientist Karl Landsteiner in 1901^{13,14}.

The relationship between blood groups and many diseases with high mortality and morbidity has become the subject of investigation in the literature over time. One of the most interesting of these studies is the relationship between blood groups and cancer⁴. In this study, we examined the relationships between cancer types, which are frequently encountered in general surgery practice, with AB0 and Rh blood groups, in the light of the literature. In this context, stomach, colorectal, breast, thyroid and pancreatic cancers were included in the study.

When all cancers are considered in our study, it was observed that cancers were more common in men than women. This finding is consistent with GLOBOCAN data¹⁵. The average age of all cancer patients was 63.31. Although most of the errors are between the ages of 60-79, thyroid and breast cancers were seen at a younger age in accordance with the literature¹⁵.

7% of all cancers were stomach cancer, 9.7% colorectal, 9.9% breast, 7.9% thyroid, 2.6% pancreatic cancer. Although these rates are similar to GLOBOCAN data, we see that the rate of thyroid cancer is much higher. We think that this difference may be due to the susceptibility that arises due to geographical factors.

In recent studies, it has been reported that gastric cancer is twice as high in males compared to females¹⁵. In our study, the results were compatible with the literature (Table 1). The relationship of blood groups with gastric cancer is somewhat complicated. Different views and studies have been made. However, the general opinion is that cancer incidence is higher in A blood group, but peptic ulcers are more common in 0 blood groups¹⁶. In our results, the majority of the patients were A blood type (43.4%) and the second 0 blood type was (29.3%) (Table 4). However, no significant difference was found between blood group distribution of all cancers and gastric cancer blood group distribution. ($p=0,556$). Although it has been reported in the literature that A blood group is a risk factor for gastric cancer, A blood group was not observed as a risk factor for gastric cancer in our patient series.

When the relationship between colorectal cancers and blood group is examined, although it is reported that A blood group is mainly observed in the literature, it is not reported as a risk factor¹⁷. In our study, when evaluated in terms of ABO blood group, although it was observed to be the most common in the A blood group, there was no statistically significant difference between all cancers and colorectal cancers in terms of ABO blood group distribution ($p=0,093$). However, when all cancers and colorectal cancers were evaluated together with ABO and Rh groups, the A Rh (+) blood group was found to be statistically significantly higher in colorectal cancers ($p=0,004$).

When the literature is examined, many studies are found on the genetic distributions of breast cancer. In a study of 3944 cases that evaluated breast cancers in terms of ABO blood group, it was reported that the most common blood type was A and O blood type was the second. In the same study, it was reported that 88.2% of the patients were Rh (+) and 11.8% were Rh (-)¹⁸. In our study, blood type A was the most common and blood type O was the second most common. In addition, 87.9% of our patients were determined as Rh (+) and 12.1% as Rh (-). These results are consistent with the literature (Table 4). No significant difference was found between blood group distribution of all cancers and breast cancer blood group distribution ($p=0,355$).

Thyroid cancer, which can be seen at any age from childhood, is the most common endocrine cancer. It is seen in 2% of children. It is seen 3 times more in women than in men.¹⁹ Our study was most common in the 40-59 age range and the second most common in the 60-79 age range (Table 5). The mean age of the patients was 55.1 (Table 2). While the number of female cases was 500, the number of male cases was 125. Thyroid malignancy was observed 4 times more frequently in female gender than male gender (Table 1). When the literature is examined, it is accepted that the incidence of thyroid malignancy is higher in the A blood group. A study by Tam et al. showed that non-thyroid spread was more frequent in B blood group proportionally²⁰. In our study, A blood group was found in the first frequency in patients with thyroid malignancy (Table 4). While 88.8% of the cases were Rh (+), 11.2% of them were Rh (-) (Table 3). No significant difference was found between the blood group distribution of all cancers and the blood group distribution of thyroid cancers ($p=0,643$).

In a recent study; It has been reported that 44.6% of pancreatic cancer patients have A, 20.7% B,

12.3% AB and 22.4% O blood group²¹. Similar results were obtained in our study. It was observed that 42.1% of the patients were most common with A blood group. No significant difference was found between ABO and Rh blood group distribution of all cancers and blood group distribution of pancreatic cancers ($p=0,735$).

In a study by Aktaş et al., they examined the distribution of ABO and Rh blood groups in the Sivas region, they reported that 87.3% of the cases were Rh (+) and 12.6% were Rh (-). In addition, 38.4% of these patients had A Rh (+), 27.8% O Rh (+), 14.2% B Rh (+), 6.8% AB Rh (+), 5.5% A Rh (-), 4.08% O Rh (-), 2.03% B Rh (-) and 0.9% AB Rh (-) reported that it was²². It was observed that there was no significant difference between these results and the blood group distribution of all cancer patients detected in our study.

CONCLUSION

As a result, contrary to the publications reporting that blood groups stand out as risk factors in different types of cancer, in our case series, when ABO and Rh blood groups were compared separately, it was observed that there was no risk factor in the development of general cancer and especially in the development of stomach, colorectal, pancreatic, breast and thyroid cancers. When comparing the cancer groups by evaluating ABO and Rh groups together, the A Rh (+) blood group was found to be higher in colorectal cancers compared to other cancers. A Rh (+) blood group may predispose to colorectal cancers. However, more comprehensive studies are needed on this subject.

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