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Original Article

# Prognostic Value of ABO Blood Group in Patients Undergoing Colorectal Cancer Surgery: A Single-Center Experience

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**Keywords:** Blood type; colorectal cancer; prognosis.



## ABSTRACT

**Objective:** It has been observed in previous studies that there is a relationship between ABO blood type and gastrointestinal system cancers. However, in studies conducted in different centers, the relationship between the blood type and cancer did not yield the same result. In this single-center study, we investigated the relationship of blood type with colorectal cancer and its effect on prognosis.

**Methods:** A total of 313 patients who underwent curative surgery for colorectal cancer between January 2013 and December 2019 were included in the study. Data were analyzed retrospectively. Patients with emergency surgery, palliative resection, unavailable records, and distant metastases were excluded from the study.

**Results:** While A blood type was more common in women, other blood types were more common in men. The overall survival for patients with AB blood type was 53.776±7.655 months. And it was significantly worse than the other groups. When examined in the multivariate Cox regression analysis, it was seen that the blood type was effective on the prognosis.

**Conclusion:** It was observed that the ABO blood type had an effect on prognosis in colorectal cancer patients.

## INTRODUCTION

Colorectal cancer is the third leading cause of death in the world. Although its incidence is increasing in developing countries, it is the 4th most frequently diagnosed cancer.[1] Both environmental factors and genetic factors play an important role in its etiology. The majority of patients are sporadic, and approximately 15–20% of the patients have a positive family history.[2] Karl Landsteiner discovered blood group antigens in 1901. It was observed that these antigens, which were initially found in erythrocytes, were particularly associated with coronary artery disease and thromboembolism.[3] Subsequently, studies were carried out regarding its relationship with malignancy, as it was found in endodermal epithelial cells.[4] These antigens could participate in modifying intracellular adhesion, membrane signaling, and immune surveillance, which was thought to affect tumorigenesis.[5]

Bai-Lin Zhang et al.[6] reported that A blood type is associated with an increased risk of cancer, while O blood type is associated with a decreased cancer risk. Also, there are studies on the relationship of blood type with breast cancer,[7] lung cancer,[8] and gastrointestinal system cancers.[7–9]

Xu et al.[10] reported that the A blood type is associated with gastric cancer. Mao et al.[11] also stated that the A blood group and the AB blood group are associated with gastric cancer.

In addition, there are studies on colorectal cancer and blood type, and different results have been reported. There are different articles about the relationship between blood type and colorectal cancer. For example, it has been reported that it is not associated with the risk of developing colorectal cancer,[5] that it is associated with the prognosis of patients with rectal cancer,[12] and that colorectal cancer is more common in A blood type.[13] Our aim in this study is to evaluate the relationship between blood group and colorectal cancer and its effect on prognosis.

## MATERIALS AND METHODS

### Patients

A total of 313 patients operated for colorectal cancer between 01.01.2013 and 31.12.2019 in Kosuyolu High Specialty Training and Research Hospital Gastrointestinal Surgery Clinic were retrospectively analyzed. Patients who underwent curative surgery were included in the study. Patients who underwent emergency surgery, had palliative resection, had no records, and had distant metastases were excluded from the study. This study was approved by the clinical research ethics committee of our institution (Ethical Committee No. 2020.4122-327).

### Data

Demographic and clinicopathological features were retrospectively analyzed from medical records. Age, gender, presence of Rh antigen, body mass index, smoking history, tumor localization, pT status, pN status, pM status, pTNM stage, lymphovascular invasion, perivascular invasion, histological grade, complications, and hospital stay were examined. Complications were considered as the first 30 days in the postoperative period or the period until discharge in the case of a longer hospital stay. Colorectal cancer classification was made according to AJCC 8th Edition.[14] 30 October 2020 was taken as the last follow-up period of the patients.

### Statistical analysis

The normality of the data was analyzed with a Kolmogorov-Smirnov test. Qualitative data were presented as frequency and percentage, and quantitative data were expressed as median (IQR). The association between the ABO blood type and the categorical variables was analyzed using Chi-square and likelihood ratio tests. Kruskal Wallis test was used for numerical data. The Kaplan-Meier test evaluated the survival effect of blood groups. The pairwise log-rank test was used for statistical analysis. A univariate and multivariate analysis was carried out using a Cox regression stepwise analysis to assess the prognostic factors for survival, including blood type, Rh antigen, gender, age, localization, pT status, pN status, TNM stage, lymphovascular invasion, perineural invasion, histological grade and complication. The IBM SPSS Statistics software package, version 22 for Windows (SPSS INC. Chicago, IL, USA), was used for the study's statistical analyses. P<0.05 was accepted as statistical significance

## RESULTS

313 patients who underwent curative surgery for colorectal cancer were compared in terms of demographic, clinicopathological characteristics, and postoperative complications according to their blood groups. According to blood groups, there was no statistical difference between the groups in terms of age, Rh antigen, BMI, smoking, localization, T stage, N stage, M stage, TNM status, lymphovascular invasion, perineural invasion, histological grade, complications, and length of hospital stay. It was observed that there was a statistically significant difference between the groups in terms of gender (p=0.027) (Table 1). While 51.6% of the patients in A blood type were women, it was 48.4% in men. 0, B, and AB blood type was more common in males (66.1%, 64.8%, 65.2% respectively).

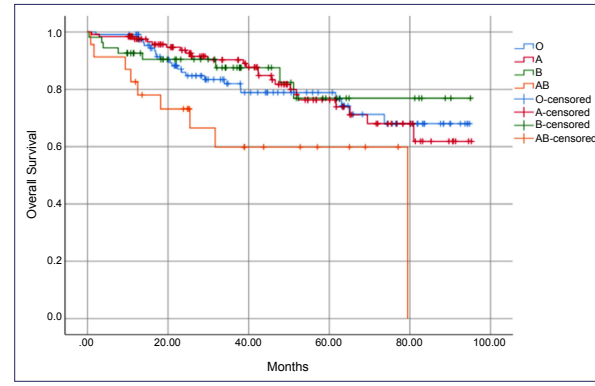


**Figure 1.** Overall survival analysis with Kaplan-Meier test according to blood type.

When analyzed with the Kaplan Meier test, a statistically significant difference was found between the groups regarding overall survival (p=0.040) (Fig. 1). The AB blood group's overall survival was 53.776±7.655 months, while the mean survival for the non-AB blood group was over 70 months (Table 2).

Prognostic factors affecting overall survival were evaluated by univariate and multivariate cox regression analysis. In univariate and multivariate analysis, Rh, gender, age, N status, TNM stage, lymphovascular invasion, perineural invasion, and histological grade were found to have no prognostic significance on survival. While T stage and complication status had prognostic significance in univariate analysis (p=0.024, p=0.038, respectively), blood groups and localization were of prognostic significance in multivariate analysis (p=0.029, p=0.013, respectively). Patients with the AB blood group had a worse prognosis on surveillance with 2.926 (1.263–6.782) times compared to the 0 blood group. The survival of patients with rectal cancer had a 0.505 (0.294–0.866) times worse prognosis than colon cancer patients (Table 3).

## DISCUSSION

Various studies have been carried out on the relationship between the ABO blood group and cancer development and survival. In this study, we investigated the impact of the blood group on the prognosis of patients who underwent curative surgery for colorectal cancer in a single center.

There are different results in the literature regarding the relationship between blood type and colorectal cancer. Khalili et al.[5] reported that no significant difference was observed between the ABO blood group and the risk of developing colorectal cancer. On the other hand, Huang

**Table 1.** Relationship of ABO blood type with demographic characteristics, clinicopathological factors and postoperative complications

| | 0 | A | B | AB | p |
|---|---|---|---|---|---|
| | n (%) | n (%) | n (%) | n (%) | |
| Gender | | | | | |
| Male | 74 (66.1) | 60 (48.4) | 35 (64.8) | 15 (65.2) | 0.027 |
| Rh | | | | | |
| Positive | 97 (86.6) | 104 (83.9) | 45 (83.3) | 21 (91.3) | 0.757 |
| BMI, kg/m$^2$ | | | | | |
| <18.5 | 1 (0.9) | 1 (0.8) | 0 (0.0) | 0 (0.0) | 0.437[a] |
| 18.5–25 | 41 (36.6) | 31 (25.0) | 15 (27.8) | 5 (21.7) | |
| >25 | 70 (62.5) | 92 (74.2) | 39 (72.2) | 18 (78.3) | |
| Smoking history | | | | | |
| No | 73 (65.2) | 99 (79.8) | 40 (74.1) | 15 (65.2) | 0.071 |
| Localization | | | | | |
| Colon | 77 (68.8) | 80 (64.5) | 34 (63.0) | 14 (60.9) | 0.814 |
| pT status | | | | | |
| pT1 | 8 (7.1) | 11 (8.9) | 5 (9.3) | 1 (4.3) | 0.095[a] |
| pT2 | 14 (12.5) | 16 (12.9) | 6 (11.1) | 3 (13.0) | |
| pT3 | 73 (65.2) | 78 (62.9) | 37 (68.5) | 16 (69.6) | |
| pT4 | 17 (15.2) | 19 (15.3) | 6 (11.1) | 3 (13.0) | |
| pN status | | | | | |
| pN0 | 64 (57.1) | 72 (58.1) | 34 (63.0) | 10 (43.5) | 0.657[a] |
| pN1 | 32 (28.6) | 36 (29.0) | 12 (22.2) | 7 (30.4) | |
| pN2 | 16 (14.3) | 16 (12.9) | 8 (14.8) | 6 (26.1) | |
| pM status | | | | | |
| No | 97 (86.6) | 115 (92.7) | 46 (85.2) | 19 (82.6) | 0.267 |
| pTNM stage | | | | | |
| Stage I | 17 (15.2) | 22 (17.7) | 8 (14.8) | 4 (17.4) | 0.364 |
| Stage II | 44 (39.3) | 48 (38.7) | 26 (48.1) | 5 (21.7) | |
| Stage III | 36 (32.1) | 45 (36.3) | 12 (22.2) | 10 (43.5) | |
| Stage IV | 15 (13.4) | 9 (7.3) | 8 (14.8) | 4 (17.4) | |
| LVI | | | | | |
| No | 76 (67.9) | 80 (64.5) | 41 (75.9) | 16 (69.6) | 0.517 |
| PNI | | | | | |
| No | 84 (75.0) | 90 (72.6) | 37 (68.5) | 20 (87.0) | 0.389 |
| Differentiation | | | | | |
| Well | 19 (17.0) | 23 (18.5) | 4 (7.4) | 4 (17.4) | 0.653 |
| Moderately | 76 (67.9) | 85 (68.5) | 43 (79.6) | 16 (69.6) | |
| Poorly | 17 (15.2) | 16 (12.9) | 7 (13.0) | 3 (13.0) | |
| Complication | | | | | |
| Yes | 68 (60.7) | 78 (62.9) | 29 (53.7) | 16 (69.6) | 0.550 |

| | Median | IQR | Median | IQR | Median | IQR | Median | IQR | |
|---|---|---|---|---|---|---|---|---|---|
| Age (years) | 62 | 53–69 | 64 | 54–70 | 66 | 54–73 | 59 | 52–70 | 0.327[b] |
| Length of stay (d) | 8 | 7–14 | 8 | 7–14 | 8 | 7–13 | 8 | 7–15 | 0.728[b] |

[a]Likelihood Ratio; [b]Kruskal Wallis; BMI: Body mass index; LVI: Lymphovascular Invasion; PNI: Perineural Invasion.

et al.[15] stated that the risk of developing colon cancer in patients with A blood group is approximately 20% higher than that of non-A blood group. Some studies have also shown that patients with A blood type have a higher risk of developing colon cancer.[16] In our study, it was seen that the majority of the patients were in the A and 0 blood groups, and the A blood group was more in the female gender.

There are also many studies on the relationship between survival and blood group in cancer patients, and it has been observed that their results differ from each other. When

the literature on this subject is examined, it is seen that there are many studies on pancreatic cancer. In a cohort study, it was reported that those with blood type A, B, or AB have an elevated risk of pancreas cancer.[16] Dandona et al.[17] found no relationship between blood types and pancreatic cancer survival in their study, whereas Ben et al.[18] reported that survival was better in the 0 blood group. Cao et al.[19] reported that the survival of colon cancer patients with the AB blood group was better. Khalili et al.[5] examined two prospective cohort studies and found no significant relationship between the ABO blood type and colorectal cancer. Differently, in our study, it was observed that the overall survival of patients in the AB blood type (53.776±7.655 months) was less than the other blood types (overall survival over 70 months).

**Table 2.** Comparison of overall survival of patients according to blood type

| | Overall survival | | | p |
|---|---|---|---|---|
| **Blood type** | **Mean** | **±SE** | **95% CI** | |
| O | 76.362 | 3.328 | 69.838–82.885 | |
| A | 77.562 | 3.132 | 71.423–83.701 | |
| B | 79.812 | 4.908 | 70.192–89.432 | |
| AB | 53.776 | 7.655 | 38.772–68.780 | |
| Overall | 76.124 | 2.069 | 72.068–80.179 | 0.040 |

SE: Standard error; CI: Confidence interval.

In our study, in the multivariate analysis, it was seen that the blood type together with the localization had prognostic importance. Cao et al.[19] reported that the prognosis was better in colorectal cancer patients with the AB blood group, we found that patients with the AB blood group had a worse prognosis.

Various studies have been conducted around the world on the relationship and prognosis of blood types with cancer,

**Table 3.** Univariate and multivariate analyses for overall survival in patients undergoing primary tumor resection

| | Univariate analysis | | | Multivariate analysis | | |
|---|---|---|---|---|---|---|
| | **OR** | **95.0% CI** | **p** | **OR** | **95.0% CI** | **p** |
| Blood type | | | 0.053 | | | 0.029 |
| 0 | | | | | | |
| A | 0.904 | 0.507–1.612 | 0.732 | 0.785 | 0.429–1.435 | 0.432 |
| B | 0.837 | 0.374–1.874 | 0.666 | 0.785 | 0.342–1.800 | 0.568 |
| AB | 2.497 | 1.152–5.411 | 0.020 | 2.926 | 1.263–6.782 | 0.012 |
| Rh | 0.711 | 0.360–1.406 | 0.327 | 1.757 | 0.841–3.672 | 0.134 |
| Gender | 1.466 | 0.894–2.404 | 0.130 | 0.628 | 0.367–1.075 | 0.090 |
| Age (years) | 1.009 | 0.988–1.030 | 0.397 | 1.017 | 0.993–1.041 | 0.164 |
| Localization (colon/rectum) | 1.636 | 0.997–2.683 | 0.051 | 0.505 | 0.294–0.866 | 0.013 |
| pT status | | | 0.024 | | | 0.054 |
| pT1 | | | | | | |
| pT2 | 2.442 | 0.519–11.504 | 0.259 | 0.233 | 0.023–2.350 | 0.217 |
| pT3 | 2.217 | 0.534–9.209 | 0.273 | 0.480 | 0.102–2.263 | 0.353 |
| pT4 | 4.893 | 1.130–21.186 | 0.034 | 0.415 | 0.218–0.793 | 0.008 |
| pN status | | | 0.272 | | | 0.583 |
| pN0 | | | | | | |
| pN1 | 1.247 | 0.699–2.222 | 0.455 | 0.903 | 0.191–4.272 | 0.897 |
| pN2 | 1.692 | 0.887–3.227 | 0.111 | 0.664 | 0.302–1.462 | 0.310 |
| TNM stage | | | 0.376 | | | 0.509 |
| Stage 1 | | | | | | |
| Stage 2 | 1.124 | 0.501–2.526 | 0.776 | 0.526 | 0.072–3.860 | 0.528 |
| Stage 3 | 1.511 | 0.678–3.363 | 0.312 | 0.533 | 0.139–2.045 | 0.359 |
| Stage 4 | 1.992 | 0.767–5.175 | 0.157 | 0.546 | 0.219–1.357 | 0.193 |
| Lymphovascular invasion | 1.218 | 0.725–2.046 | 0.455 | 1.036 | 0.523–2.052 | 0.918 |
| Perineural invasion | 1.092 | 0.618–1.929 | 0.763 | 0.894 | 0.452–1.767 | 0.748 |
| Histological grade | | | 0.052 | | | 0.144 |
| Well differentiated | | | | | | |
| Moderately differentiated | 1.791 | 0.710–4.522 | 0.217 | 0.578 | 0.178–1.879 | 0.362 |
| Poorly differentiated | 3.190 | 1.148–8.864 | 0.026 | 0.511 | 0.262–0.997 | 0.049 |
| Complication | 1.824 | 1.034–3.218 | 0.038 | 1.374 | 0.753–2.508 | 0.301 |

CI: Confidence interval; OR: Odds ratio.

and the results of the studies have been different from each other, like our study. This may be because the blood group is inherited, as with some cancers. The limitations of the study are that it is retrospective and single-center. To achieve more accurate results, more and multi-center studies should be done.

### Ethics Committee Approval

This study approved by the University of Health Sciences, Kosuyolu High Specialty Training and Research Hospital Non-Interventional Clinical Research Ethics Committee (Date: 08.05.2020, Decision No: 2020.4122-327).

### Informed Consent

Retrospective study.

### Peer-review

Internally peer-reviewed.

### Authorship Contributions

Concept: A.S.S., O.U.; Design: A.S.S., O.U.; Supervision: S.G., M.D.; Fundings: I.E.S., A.S.S.; Materials: Ö.Ö., A.S.S.; Data: C.B.O., S.G., E.P.; Analysis: A.Ö., A.S.S., Ö.Ö.; Literature search: A.S.S., A.Ö., S.G.; Writing: A.S.S., O.U., I.E.S.; Critical revision: A.S.S., M.D., S.G.

### Conflict of Interest

None declared.

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## Kolorektal Kanser Ameliyatı Geçiren Hastalarda ABO Kan Tipinin Prognostik Değeri: Tek Merkez Deneyimi


**Amaç:** Önceki çalışmalarda ABO kan grubu ile gastrointestinal sistem kanserleri arasında bir ilişki olduğu gözlemlenmiştir. Ancak farklı merkezlerde yapılan çalışmalarda kan grubu kanser ilişkisi aynı sonucu vermemiştir. Biz de tek merkezli yapılan bu çalışmada kan grubunun kolorektal kanser ile ilişkisini ve prognoza etkisini araştırdık.

**Gereç ve Yöntem:** Çalışmaya Ocak 2013 ile Aralık 2019 yılları arasında kolorektal kanser nedeniyle küratif cerrahi yapılan toplam 313 hasta dahil edildi. Veriler geriye dönük olarak analiz edildi. Acil ameliyat olan, palyatif rezeksiyon yapılan, kayıtlarına ulaşılamayan ve uzak metastazı olan hastalar çalışma dışı bırakıldı.

**Bulgular:** A kan grubu kadınlarda daha sık görülürken diğer kan grupları erkeklerde daha fazla idi. AB kan grubundaki hastalarda ortalama yaşam süresi 53.776±7.655 ay idi. Ve diğer gruplara oranla anlamlı olarak daha kötü idi. Multivaryant Cox regresyon analizinde incelendiğinde ise kan grubunun prognoza etkili olduğu görülmüştür.

**Sonuç:** ABO kan grubunun kolorektal kanser hastalarında prognoza etkili olduğu görüldü.



**Anahtar Sözcükler:** Kan grubu; kolorektal kanser; prognoz.