*Original Article*

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# Can our Blood Groups Determine our Life Expectancy?

## *Kan Gruplarımız Hayat Uzunluğumuzu Belirleyebilir mi?*

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**ABSTRACT**

***Objective:*** *In this study, we aimed to investigate the relationship between long-term mortality and survival in patients with ABO blood group, and acute coronary syndrome.*
***Method:*** *This observational study was carried out in two tertiary hospitals. A total of 192 patients followed up for 72 months due to acute coronary syndrome, and showing a balanced distribution for ejection fraction, additional diseases and age, were included in the study.*
***Results:*** *The survival rate was evaluated in 72 months of follow-up. In the survival analysis made according to individual blood groups; a statistically significant difference was not detected between groups. When the patients were divided into two groups, mortality rates were 24.39% in patients with, and 15.23% without blood group O (p>0.05). Although not statistically significant, in patients with blood group O, an increasing tendency was observed in 72 month-mortality rates (p>0.05). Any association between Rh antigen and survival was not found in this study (p=0.79).*
***Conclusion:*** *Although it could not reach the limit of statistical significance, a decreasing tendency in long-term survival was observed in acute coronary syndrome patients with blood group O compared to those without The results should be confirmed by larger prospective studies.*

***Keywords:*** *acute coronary syndrome, ABO blood groups, mortality, survival*

**ÖZ**

***Amaç:*** *Bu çalışmada akut koroner sendromlu hastalarda ABO kan grubu ile sağkalım ve uzun-süreli mortalite arasındaki ilişkiyi araştırmayı amaçladık.*
***Yöntem:*** *Bu gözlemsel çalışma, iki adet üçüncü basamak hastanede gerçekleştirildi. Ejeksiyon fraksiyonu, ek hastalıklar ve yaş için dengeli bir dağılım gösteren akut koroner sendrom nedeniyle 72 ay takip edilen 192 hasta çalışmaya dahil edildi.*
***Bulgular:*** *Sağkalım oranı 72 aylık takipte değerlendirildi. Bireysel kan gruplarına göre sağkalım analizinde; gruplar arasında istatistiksel olarak anlamlı fark yoktu. Hastalar iki gruba ayrıldığında, O kan grubu olanlarda % 24.39, O kan grubu olmayanlarda % 15.23 mortalite vardı (p> 0.05). İstatistiksel olarak anlamlı olmasa da, O kan grubundaki hastalarda 72 aylık mortalitede artış eğilimi gözlendi (p> 0.05). Bu çalışmada Rh antijeni ile sağkalım arasında bir ilişki yoktu (p = 0.79).*
***Sonuç:*** *İstatistiksel olarak anlamlılık sınırına ulaşamamasına rağmen, akut koroner sendromlu hastalarda O kan grubu olmayanlara göre O kan grubundaki hastalarda uzun dönem sağkalımda azalma eğilimi gözlenmiştir. Sonuçlar daha büyük prospektif çalışmalarla doğrulanmalıdır.*

***Anahtar kelimeler:*** *akut koroner sendrom, ABO kan grupları, mortalite, sağkalım*

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## INTRODUCTION

As is known, cardiovascular diseases are the first cause of death in the world. Cholesterol, smoking, exercise, healthy lifestyle, fighting obesity are important factors effective on mortality. But what about our family story, and our blood groups ? It has long been known that ABO blood type has an effect on hemostasis and is an important determinant of plasma levels of von Willebrand factor (VWF) and thus factor VIII (FVIII) [1]. VWF has two main functions in hemostasis. First, it is important for platelet-subendothelial adhesion and plate-platelet interactions and platelet aggregation. Second, VWF is the specific carrier of factor VIII (FVIII) in plasma and prolongs its biological half-life in circulation and protects factor VIII (FVIII from proteolytic degradation at the site of vascular injury [2]. VWF level is closely related to hemostasis. While decreased VWF levels cause hemorrhagic diathesis (von Willebrand disease, VWD) [2], some studies have demonstrated that increased VWF level is an important thrombotic risk factor [3,4]. Following the studies investigating the relationship between DVT and blood groups, the relationship between ABO blood group and hemostasis has attracted the attention of many investigators, and the relationship between blood groups, coronary artery disease and survival was the subject of interest. Not all, but most studies have shown that those without blood group O have a higher risk of venous thromboembolism (VTE) than those with blood group O [1,5,6]. Hereditary thrombophilic factors such as factor V Leiden and prothrombin G20210A mutation are also responsible for a moderate increase in thrombotic risk, and some authors also suggest ABO blood group analysis when evaluating the risk profile in thrombophilic individuals. In this study, we aimed to investigate the relationship between long-term mortality and survival with ABO blood group in patients with acute coronary syndrome.

## MATERIALS and METHODS

This observational study was conducted in two tertiary heart centers. A total of 192 patients who were hospitalized in the coronary care units of these centers between January 1, 2013 and December 31, 2013 were included in the study. The patients with acute coronary syndrome who had been followed up for 72 months were treated were matched according to age, disease and ejection fraction. Patients who were not followed up for 72 months, deceased cardiovascular patients identified from the state official database, and death notification system that only the physicians were able to enter were recorded, and included in the study. However deaths related to other etiologies (malignancy, accident, non-cardiovascular system diseases were excluded from the study. In our study, we examined the relationship between blood groups, diseases and survival. FV Leiden gene mutation, FVIII and vWF values that were not routinely examined and therefore not determined by retrospective examination were not included in the study data. Blood grouping was performed by microplate method based on hemagglutination method. The present study was conducted and reported in accordance with the declaration of the Principles of Helsinki, International Conference on Harmonization (ICH), Good Clinical Practice (GCP) and STROBE guidelines. The local ethics committee approval was obtained for the study protocol.

### Statistical analysis

Analyzes were performed using the MedCalc Statistical Software version 12.7.7 (MedCalc Software, Belgium) and NCSS 11(Number Cruncher Statistical System, 2017 Statistical Software). Frequency, percentage values were given for categorical , and . mean, standard deviation, median, minimum and maximum values for continuous variables. Survival times were evaluated by survival analysis. Chi-square analysis was used for the relationships between categorical variables. Where appropriate, the categorical variables were evaluated using the Fisher Freeman Halton Test. Independent sample t test was used for comparison of two groups as for continuous independent variables showing normal distribution, and Mann- Whitney U test was used for comparison of two independent groups in variables that did not comply with the normal distribution assumption. Kruskall -Wallis H test was used in the comparison of two groups in case of need. Statistical significance level was determined as 0.05. Bonferroni correction analyzes were made.

## RESULTS

The study population (n= 192) that was followed up, had blood groups O (n=41: 21.35%) A (n= 106

:55.21%) , B (n= 26 :13.54%) , and AB (n=19 :9.9%). Survival rate was assessed based on 72-month follow-up. Regardless of Rh antigen; statistically significant difference was not found between the blood groups as for survival rates (Table 1). According to Bonferroni correction, life expectancy did not differ significantly between blood groups (p > 0.012). The lowest mean survival was 61 months for blood group B and 62.4 months for blood group O. The longest survival was 67.1 months in patients with blood group A.

**Table 1. Survival analysis according to blood groups.**

| Blood Groups | Survival (Mean± SD years) | 95% CI | Log Rank P |
|---|---|---|---|
| 0 | 62.415 ± 3.312 | 55.924 – 68.906 | 0.4799 |
| A | 67.142 ± 1.479 | 64.242 – 70.041 | |
| B | 61.000 ± 4.570 | 52.043 – 69.957 | |
| AB | 66.105 ± 3.433 | 59.377 – 72.833 | |
| Overall | 65.198 ± 1.303 | 62.644 – 67.752 | |
| Bonferroni Correction significance level p > 0.012 | | | |

**Table 2. Mortality in patients with and without blood group O.**

| Blood groups n | Survival | | Mortality | |
|---|---|---|---|---|
| | % | n | % | |
| Blood group0 | 31 | 75.61 | 10 | 24.39 |
| Non-0 blood group | 128 | 84.77 | 23 | 15.23 |

The patients were divided into two groups as with an without blood group O, Mortality rates were 24.39 %, and 15.23 % in those with, and without blood group O, respectively (p > 0,05) (Table 2). Although it was not statistically significant, an increase in 72-month mortality rate was observed in patients with blood group O. Though not statistically significant, there was a declining trend in survival in patients with blood group O (62.41 ± 21:47) compared to those without (65.95 ± 8.17) (p > 0.05) (Table 3, Figure 1). According to Bonferroni correction, life expectancy did not differ significantly between two groups (p> 0.025) (Table 3).

When the relationship between Rh antigen and survival was evaluated, no significant difference was found. The mean survival times in Rh- positive , and negative patients were 65.3, and 64.3 months, respectively (Table 4, Figure 2). Demographic characteristics of patients with and without blood group O are given in Table 5. There was no difference between both groups.

**Table 4. Survival analysis according to the presence of Rh antigen.**

| | Survival (Mean ± SD years) | 95% CI. | Log Rank P |
|---|---|---|---|
| Rh negative | 64.375 ± 3.280 | 57.947 – 70.803 | 0.7926 |
| Rh positive | 65.362 ± 1.419 | 62.581 – 68.144 | |
| Overall | 65.198 ± 1.303 | 62.644 – 67.752 | |

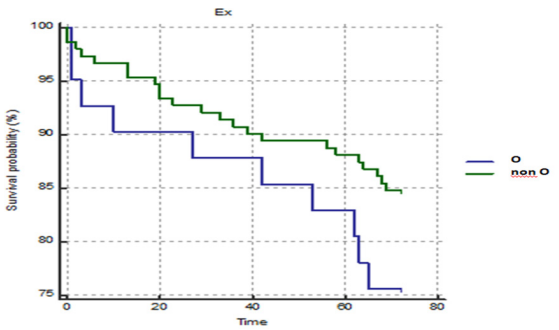


**Figure 1: Survival Analysis of patients with and without blood group 0.**

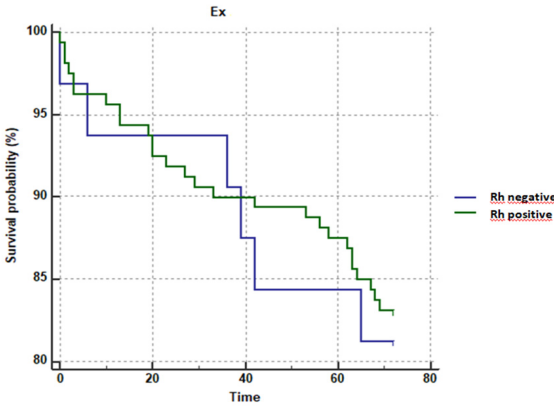


**Figure 2. Survival analysis between Rh- negative and Rh-positive patients.**

**Table 3. Survival analysis between patients with and without blood group O.**

| Blood groups | Survival (Mean± SD years) | 95% CI | Log Rank P |
|---|---|---|---|
| blood group 0 | 62.415 ± 3.312 | 55.924 - 68.906 | 0.1610 |
| Non 0 blood group | 65.954 ± 1.385 | 63.239 - 68.669 | |
| Overall | 65.198 ± 1.303 | 62.644 - 67.752 | |
| Bonferroni correction significance level: p > 0.025 | | | |

## DISCUSSION

The present study revealed that there was no statistically significant survival difference among patients with blood groups A, B, AB and O regardless of the presence of Rh antigen. Presence of Rh antigen had not a significant impact on survival. Though not statistically significant, mortality rates were 24.39 %, and 15.23 % mortality in those with, and without blood group O ($p > 0.05$). One of the few possible explanations about how ABO blood type may affect development of venous thromboembolism (VTE) is the change in clotting factor levels [1]. In general, about 70% of the variation in plasma VWF / factor VIII levels is genetically determined, with 30% of this genetic variation being caused by the ABO blood group of an individual [2].

Many studies have shown that individuals with non-O blood group have higher Factor VIIIc (FVIII) and von Willebrand factor (VWF) levels than those with blood group O [2]. Since our study had a retrospective design, and FV Leiden gene mutation, FVIII and vWF values were not evaluated routinely, we could not comment on the VWF level of our patients. When we look at the literature, a higher rate of bleeding complications has been described in patients in group O [2], whereas the relationship between non-O blood groups and the risk of arterial thromboembolic disease including ischemic heart disease and peripheral vascular disease has been supported by many studies [1,2]. In 2008, Wu et al. performed a systematic review and meta-analysis of studies reporting the association of non-0 blood groups with various vascular disorders. The authors observed a significant relationship between the non-0 blood group and increased CAD risk [7]. Carpeggiani et al., in 2010, reported that patients with non-O blood group has an increased risk of cardiac mortality [8]. In 2011, Reilly et al. showed that patients with non-0blood group had an increased risk of MI compared to those with blood group O [9]. The results obtained in the study by He et al., in 2012, were similar; individuals without blood group O had increased risk of CAD development compared to individuals with blood group 0 [10].

The results we obtained in our study were not really compatible with this prediction. While 21.35% of the patients with ACS were in blood group O, 78.65% of them were in the non-Ogroup. The most important part of our study was that we could observe the relationship between survival and blood groups during 72-month- observation rather than the relationship between the blood group and the frequency of ACS. In patients with acute coronary syndromes, long-term survival tended to decrease in blood group O compared to non-O blood group. Similar results were obtained in the study published by Johansson et al. where in patients with acute coronary syndrome, antigen O was associated with increased risk of cardiovascular death, all cause-mortality and recurrent myocardial infarction [11].

The Hoorn Study showed a 2-fold increase in cardiovascular mortality in the non-0 group

**Table 5. Demographic characteristics in patients with and without blood group 0.**

| | | blood group 0 | | Non-0 blood group | | |
|---|---|---|---|---|---|---|
| | | (Mean ± SD) | | (Mean ± SD) | | p |
| Age (years) | | 55.05 ± 11.32 | | 56.42 ± 13.12 | | 0.543 |
| LVEF (%) | | 48.37± 10.50 | | 48.37± 8.69 | | 0.642 |
| | | n | % | n | % | p |
| Gender | F | 9 | 21.95 | 23 | 15.23 | 0.306 |
| | M | 32 | 78.05 | 128 | 84.77 | |
| Diabetes | 0 | 27 | 65.85 | 115 | 76.16 | 0.182 |
| | 1 | 14 | 34.15 | 36 | 23.84 | |
| Hypertension | 0 | 8 | 19.51 | 24 | 15.89 | 0.581 |
| | 1 | 33 | 80.49 | 127 | 84.11 | |
| Hyperlipidemia | 0 | 20 | 48.78 | 84 | 55.63 | 0.435 |
| | 1 | 21 | 51.22 | 67 | 44.37 | |
| F: female, M: male, Yes: 1, No: 0, LVEF: Left ventricular ejection fraction | | | | | | |

compared to blood group O during a 5-year follow-up [12]. Januszkiewicz et al. reported all-cause mortality of 22.07% in non-O group compared with that of 17.19% in the group O during a 7-year follow-up without any statistically significant [13]. Whereas, in our study, although it was not statistically significant, an increasing trend in 72-month mortality was observed in patients with blood type 0.

On the other hand, Januszkiewicz et al., in 2013, reported that among 418 patients with ACS, mortality rates were 22.7%, and 10% in Rh-positive and Rh-negative patients , respectively (p = 0.014). D was identified as an independent predictor of mortality for Rh-positive blood group (p = 0.007) [13]. In our study, there was no association between the presence of Rh antigen and survival (p = 0.7926).

Although the data we obtained in our study were not quite consistent with previous studies, we believe that larger scale studies especially with long-term follow-ups should be performed. Major limitations of our study are small its sample size and failure to investigate other genetical abnormalities such as factor V Leiden. Although many studies in the literature show increased risk for VTE and ACS in non-O blood group, but having blood group O may be independently associated with venous thromboembolism, acute coronary syndrome and poor prognosis for other etiological reasons. In patients at risk, closer monitoring of VTE and acute coronary syndrome may be necessary considering the risk-increasing effect of blood group. In the light of this information, a more stringent policy can be adopted in terms of modifiable and correctable risk factors. Larger-scale and well-planned prospective studies are needed.

Although it was not able to reach statistically significance limit, a decreasing tendency in long-term survival was observed in patients with blood group O compared to those without among patients with acute coronary syndrome. The results should be confirmed by larger prospective studies.

**Ethics Committee Approval:** Approval was obtained from the Bakırköy Dr Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (2019/174).

**Conflict of Interest:** The authors have declared that they have not any conflict of interest.

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