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Is blood group a risk factor in lateral epicondylitis?

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Abstract. – OBJECTIVE: Lateral epicondylitis is a common disorder in the community. Identification of risk factors plays an important role in the prevention and treatment of the disease. In our study, the relationship between risk factors in lateral epicondylitis and blood group, which has not been mentioned before in the literature, will be examined.

PATIENTS AND METHODS: In our study, patients' age, height, weight, body mass index (BMI), dominant upper extremity, affected upper extremity, duration of symptoms, duration between onset of symptoms and hospital admission, occupation, number of children and youngest child age (if the patient is a mother), smoking, alcohol use, presence of additional diseases, sports activities, job requiring repetitive movements and strength in the upper extremities in daily life, marital status, where he/she lives and his/her blood type were questioned. In our study, there were 304 patients in the patient group and 304 patients in the control group.

RESULTS: In our study, blood type 0 was significantly more common in the patient group ($p<0.001$).

CONCLUSIONS: In our study, it was concluded that there is a relationship between 0 blood group and lateral epicondylitis.

Key Words:
Lateral epicondylitis, Blood group, Risk factor, Elbow, Etiology, Tendinitis, Patient.

Introduction

Lateral epicondylitis is a painful clinical condition that occurs in the lateral epicondyle, which is the starting point of the wrist extensor muscles. It is also known as tennis elbow and usually spreads to the forearm[1]. It is often seen in those who are interested in sports with repetitive wrist extension against resistance, such as tennis. It is a condition that restricts daily life due to pain experienced during gripping and hand-wrist extension[2]. Conservative treatment methods such as the use of splint, cold application over a protective surface, the use of non-steroidal anti-inflammatory drugs, physiotherapy, activity modification are used as the first treatment modality. In addition, there are other treatment methods such as ultrasound therapy, botulinum, corticosteroid, platelet-rich plasma injection, extracorporeal shock wave therapy[3].

Lateral epicondylitis is usually seen in the 4th and 5th decades of life and the dominant arm is often affected[4,5]. Its incidence is high in the working population. There is no consensus in the literature about the prevalence among women and men[6,7]. In addition, many studies[8] have been conducted to determine the etiology and risk factors.

Lateral epicondylitis is a disease associated with a multifactorial etiology with an incidence varying between 1-3% in the population. In addition to this, there are also publications[7] indicating a rate of 12.2%.

This painful clinical condition is frequently encountered by clinicians. It interrupts the daily life of the patient and creates an economic burden on society[1,9]. Depending on these and similar reasons, the etiology and risk factors of lateral epicondylitis should be determined accurately, activity modification should be done accordingly, if necessary, and the treatment regimen should be arranged accordingly.

In our study, the relationship between lateral epicondylitis and blood group was discussed, which was not mentioned before. Additionally, possible etiopathogenesis was also discussed, which distinguishes our study from other studies.

Patients and Methods

Our study is a retrospective case-control study. Our study was approved by the Ethics Committee

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of Muş Alparslan University (number E-10879717-050.01.04-2579) and included patients with a diagnosis of lateral epicondylitis who applied to our clinic between the years 2017-2020. Lateral epicondylitis was diagnosed in patients with pain in active wrist extension against resistance with pression on the lateral epicondyle and full extension of the elbow in forearm pronation.

Inclusion and Exclusion Criteria

Inclusion criteria: patients were 18 years or older, the presence of X-ray film and the absence of any pathology (for example, intra-articular loose body, osteoarthrosis), the presence of blood group in the hospital system. Patients who did not have blood group information in the hospital information management system were called by phone and their blood groups were registered.

Exclusion criteria: patients with a history of acute elbow trauma, severe weight change in the last 1 year (body change in the patient's daily clothes), history of malignancy, pregnancy, previous elbow fractures, epilepsy, cervical radiculopathy, elbow surgery history, those with additional pathologies in the elbow (such as posterior interosseous nerve neuropathy), diagnosed psychiatric disorders and the absence of necessary data in the patient file or inability to communicate with the patient.

Participants

Patients who were admitted to the hospital between 2017 and 2020 and who were not diagnosed with lateral epicondylitis were determined as the control group who met the inclusion criteria. After the patient group was created, the individuals in the patient group were selected according to their occupation, age and gender distribution. While the data of the patients in the control group and the study group were obtained, the patients were called by phone or called for control for the data not included in the patient files.

Assessment

Patients' age, height, weight, body mass index (BMI), dominant upper extremity, affected upper extremity, duration of symptoms, duration between onset of symptoms and hospital admission, occupation, number of children and youngest child age (if the patient is a mother), smoking, alcohol use, presence of additional disease, sports activities, jobs requiring repetitive movements and strength in the upper extremities in daily life, marital status, where he/she lives and his/her blood type were questioned.

In the study, while determining the ages of the patients, the date of arrival at the hospital and the date of birth in the hospital system were taken as basis. According to the nutritional status classification of the World Health Organization (WHO), BMI is classified as underweight to those below 18.5, normal weight to those between 18.5-24.9, pre-obesity to those between 25-29.9, and obesity to 30 and above. The dominant hand of the patients was determined by questioning the writing hand. Whether the patients were actively smoking and passive smoking were questioned. While investigating additional diseases, diabetes mellitus (DM), thyroid hormone disorders, de Quervain's tenosynovitis, carpal tunnel syndrome, rotator cuff pathologies (tendinitis, full-thickness or partial rotator cuff tear) were questioned. It was questioned whether repetitive movements were performed for at least 2 hours with the upper extremity in daily work and whether at least 15 kilograms of weight were lifted[10]. The patients were divided into two groups as married and single. Again, it is divided into two groups according to living in the city and in the countryside. Blood group was recommended for all patients with lateral epicondylitis. The blood groups of the patients were questioned as A, B, AB, 0 and rh +, - were ignored. While determining the blood groups, the medical history of the patients in the hospital system and the blood type specified in the official documents available to the patients were taken into consideration.

Statistical Analysis

Statistical analysis was performed using IBM® SPSS© 24 software (IBM Corp., Armonk, NY, USA). Compliance of numerical variables to normal distribution was performed using visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk tests). In comparisons, descriptive statistics for numerical variables with normal distribution were given with mean and standard deviation, while descriptive statistics of numerical variables that did not show normal distribution were expressed as median and interquartile values. Descriptive statistics of categorical variables were given using numbers and percentages. Independent Sample *t*-test was used to compare two independent groups with normal distribution, while Mann-Whitney U test was used to compare two groups, at least one of which was not normally distributed. Chi-square or Fisher's exact test was used to compare the different groups. Statistical significance level $p<0.001$ was accepted.

Table I. Distribution of the patient and control groups by age and gender.

	Patient		Control		
Age groups	**Male**	**Female**	**Male**	**Female**	**Total**
Under 30 years	20	37	20	37	114
30-40 years old	50	48	50	48	196
40-50 years old	40	52	40	52	184
50-60 years old	30	23	30	23	106
60-70 years old	0	4	0	4	8
Total	140	164	140	164	608
Average age (year) ± SD	39.63±9.49		39.51±9.40		

Results

304 patients who met the criteria, applied to the hospital for various reasons and were not diagnosed with lateral epicondylitis before were included in the study. When creating the control group, stratified sampling was used to create similarities between the patient group and the control group in terms of age and gender. There were 140 male and 164 female patients in the control and patient groups. The median value of the ages of the patients was 39 and the median value of the ages of the control group was 39 (Table I, Figure 1). Considering the patient group and the control group, the age distributions of the 2 groups were found to be similar (p>0.050), and no significant difference was found between men and women in the patient group (p>0.050).

The median values of the patient group for height, weight and body weight were 1.65 (0.09), 79.40 (14.10), 29.84 (6.11). The median values of the control group, respectively, height, weight and body mass index were 1.66 (0.09), 78.6 (14.68), 28.56 (6.07). In the patient group, 42 people were found to be normal weight, 119 pre-obese, 143 obese; in the control group, 58 people were found to be normal weight, 127 pre-obese, and 119 obese (Figure 2). There was a significant difference between the patient group and the control group, the patient group was shorter (p<0.001), there was no significant difference between the weight (p>0.050) and the body mass index difference between the patient group was higher (p<0.001).

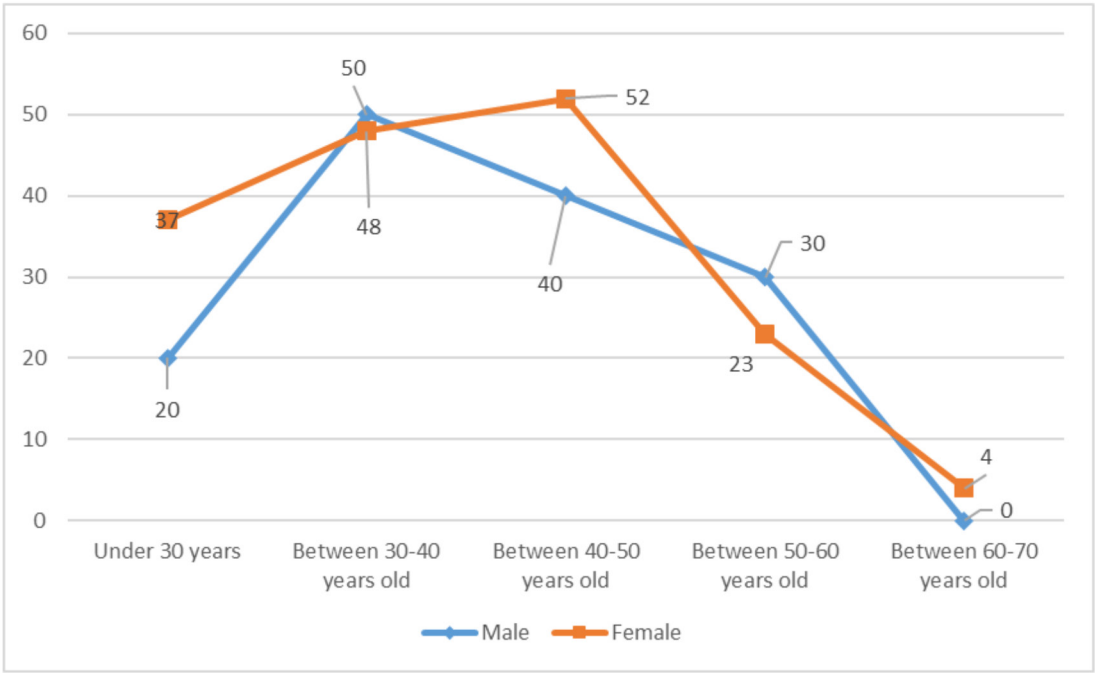

Figure 1. Age (year) distribution by gender of patients.

In the patient group, the right upper extremities of 262 people were affected, the left upper extremities of 42 people were affected, and the dominant side of 252 people was affected. The average duration of the symptoms of the patients is 166 days, after the onset of symptoms, the average duration of admission to the hospital is 96 days. It was found that the dominant side was significantly more affected ($p<0.001$).

When we look at the occupational distribution of the patients, the patients consisted of 24 farmers, 58 dealing with livestock, 149 housewives, 16 soldiers, 4 cooks, 4 waiters, 10 construction workers, 5 hairdressers, 19 desk heads, 4 drivers, 8 repairmen, and 3 tailors (Figure 3). When the individuals in the control group were compared with the patient group, they were in a similar distribution according to professions. When the patient group was evaluated statistically within itself, it was found that the disease was significantly more common in those who dealt with livestock and housewives ($p<0.001$).

The median value of the number of children in the female patient group is 3 (1), and the median value for the number of children in the female control group is 3 (2). The median value of the youngest child age of the female patient group is 72 (105) months. The median value of the youngest child age in the female control group is 84 (177) months. When the patient and control groups were compared, a significant difference was found between the patient group, and it was found that the patient group had more children ($p<0.001$) (not only the children of housewives but also the number of children of all women regardless of the profession). In addition, when the patient and control groups were compared, it was found that the youngest child age was significantly lower in the patient group ($p<0.001$).

In the patient group, there were 91 active smokers, 68 passive smokers and 145 non-smokers. In the control group, there were 44 active smokers, 90 passive smokers, 170 non-smokers. When compared statistically, it was seen that cigarette exposure was significantly higher in the patient group compared to the control group.

De Quervain's tenosynovitis in 9 patients, carpal tunnel syndrome in 21 patients, dm in 29 patients, hypothyroidism in 13 patients, rotator cuff pathology in 10 patients were detected. In the control group, de Quervain's tenosynovitis in 2 people, carpal tunnel syndrome in 10 persons, DM in 14 people, hypothyroidism in 7 persons, rotator cuff pathology in 4 people were detected (Figure 4). There was no relationship between rotator cuff pathology and hypothyroidism and the disease. De Quervain's te-

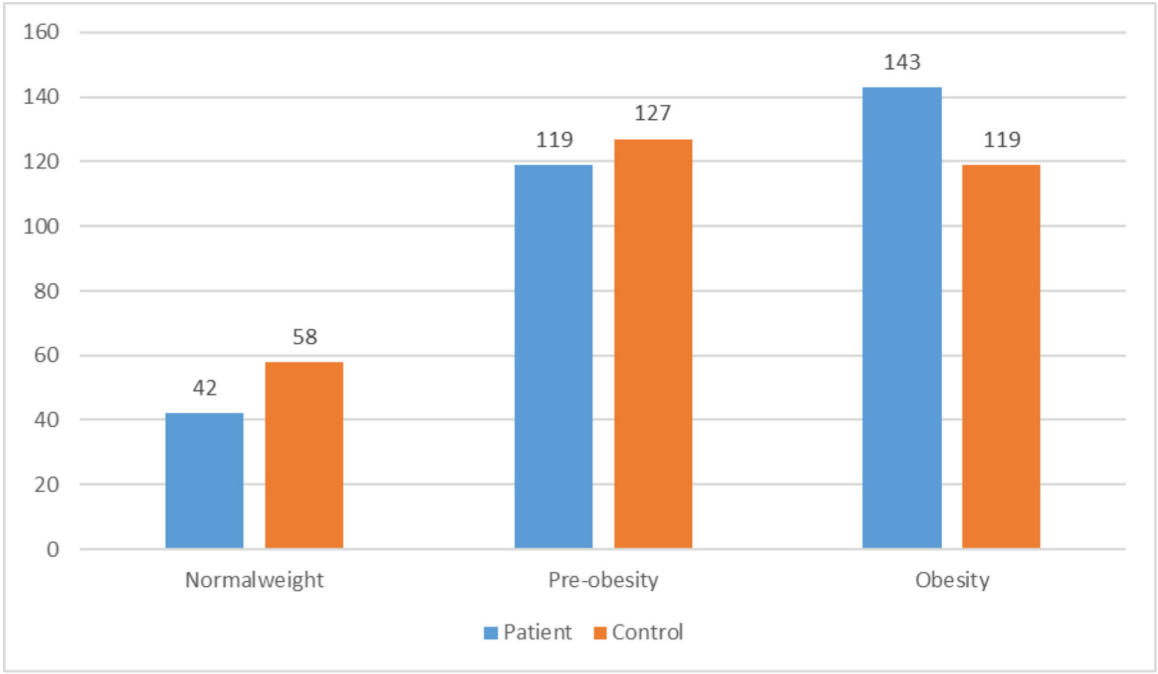

Figure 2. The distribution of the patient and control groups according to the nutritional status classification of the WHO.

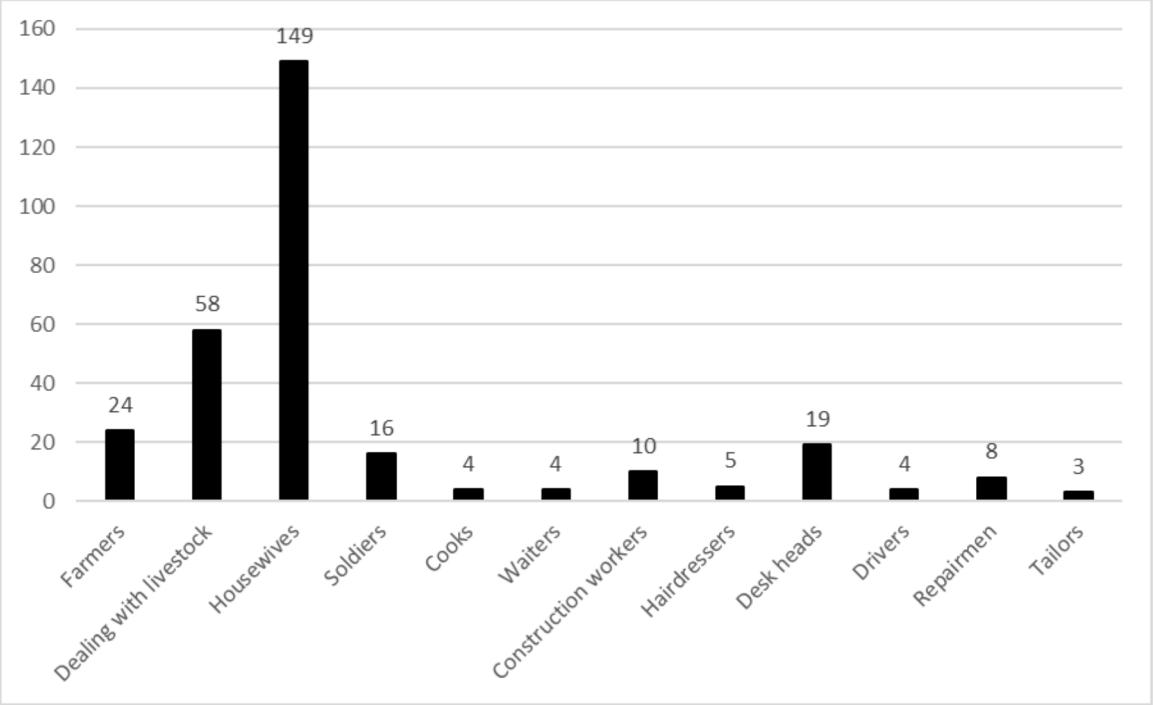

Figure 3. Distribution of patients according to their professions.

nosynovitis, DM and carpal tunnel statistically more in the patient group. None of the individuals in the patient and control groups do sports regularly.

The number of patients who made repetitive movements for any reason is 75 in the patient group, while this number is 54 in the control group. It is statistically significant in the patient group. The number of patients doing work requiring force is 80, whereas this number is 60 in the control group. Statistically, the number of patients doing work requiring repetitive motion and force was higher in the patient group (p<0.001).

195 of the patients live in rural areas and 109 live in cities. In the control group, 187 of them live in rural areas and 117 live in cities. There is no statistically significant difference between the two groups.

19 of the patients were single and 285 of them were found to be married. In the control group, it was detected that 26 were single and 278 were married. There was no significant difference between the groups (p>0.050). It was found that 1 person in the patient group and 2 people in the control group regularly used alcohol. No significant relationship was found. In the patient group, 37 people had trauma history in the elbow area, and 20 people in the control group had a history of trauma. A statistically significant relationship was found with the history of trauma. (p<0.001).

Of the individuals in the patient group, 140 were blood type A, 37 were blood type B, 98 were blood type 0, 29 blood type AB, 141 of the individuals in the control group were blood type A, 57 were blood type B, 70 were blood type 0, 36 were blood type AB (Figure 5). In our study, blood type 0 was significantly more common in the patient group (p<0.001).

Discussion

Lateral epicondylitis is a disease associated with a multifactorial etiology with an incidence varying between 1-3% in the population[4]. The frequency of the disease varies depending on gender, age, existing additional diseases, daily activity level and many other factors. Although it may seem like a simple disorder, it can create an economic burden on society if the disease is not well recognized and treated properly[1,9].

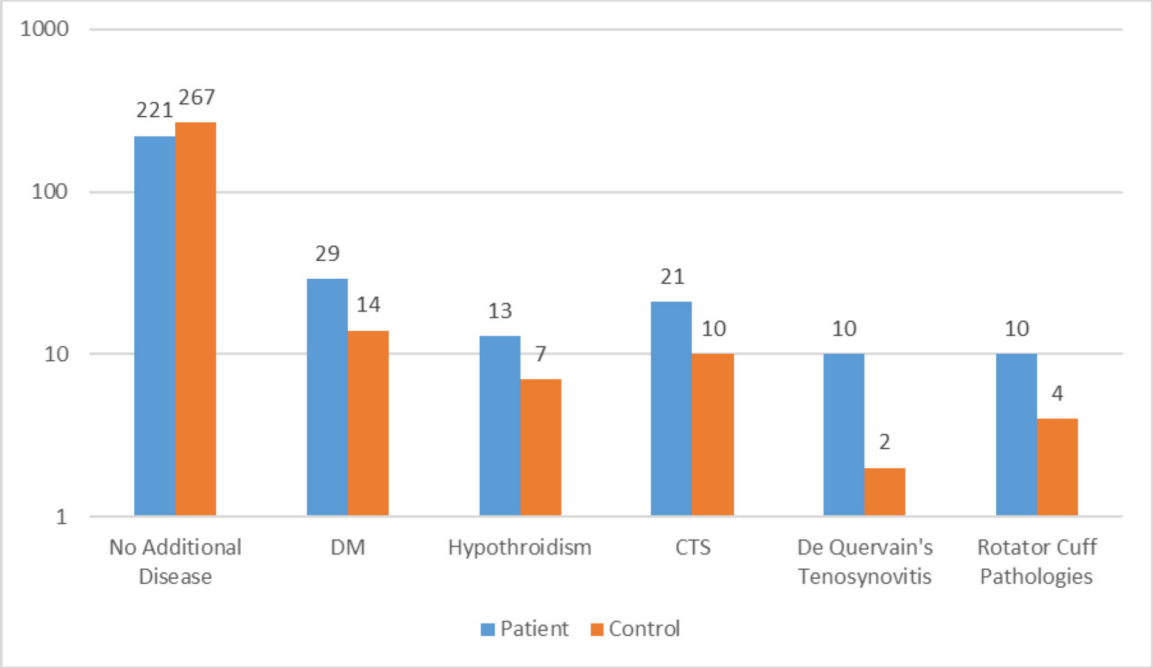

Figure 4. The distribution of the patient and control groups according to their comorbidity.

Considering the age distribution of lateral epicondylitis, it is seen that the case density is generally high in the advanced age group. The high case density in the advanced age group may be due to the result of degenerative processes depending on local and systemic factors. However, linking the pathophysiology of tendinitis to healing failure or degeneration alone is insufficient to explain the pathophysiology of the disease[11]. A "continuum model" was defined by Cook et al[12,13] to bring another perspective to tendon pathophysiology. According to this model, when tendonitis occurs, different regions of the tendon can contain reactive degenerative and normal areas at the same time. This indicates that tendinitis has a complex pathophysiology as it was originally thought. The event is further complicated by the involvement of local and systemic factors in the advanced age group. In our study, similar to the literature, we saw that patients are concentrated between the 3rd and 4th decades of life[14,15].

We believe that the lower average age in our study, compared to the literature, may be due to several factors. One factor is the region where the study was conducted, which has a high concentration of animal husbandry and farming. Another factor may be the existence of large families with many children. Additionally, the sedentary lifestyle of the elderly population due to cultural reasons could also contribute to the lower average age observed in our study.

Lateral epicondylitis is a pathology seen in both sexes. There is no consensus in the literature regarding the prevalence according to gender. Although it is reported to be seen equally in some studies[8] in the literature, there are also publications reporting that it is seen frequently in female gender. In our study, no significant difference was found between men and women in terms of the incidence.

When the height, weight and body mass index of lateral epicondylitis are compared, there is no study in the literature regarding the relationship between height and lateral epicondylitis. According to our hypothesis on this subject, if we consider that the jobs in our daily life or the job specific to the profession are similar, especially in the jobs where the upper extremity is used, the leverage arm is short in short people, although the job is the same, more energy is spent. When the patient and control groups were compared in our study, we can explain the shorter stature of the patient group with this hypothesis. However, in this hypothesis we have established a necessity to have tests done with biomechanical studies. In addition, we think that there is a relationship between obesity and lateral epicondylitis. In our study, it was found that the body mass index was significantly

higher in the patient group. Parallel to this, it has been mentioned in the literature[1,8,16] that obesity increases the load on the tendons and can trigger persistent inflammation subclinically. In addition, the frequency of lateral epicondylitis is higher in the dominant hand[1,14,16]. In our study, results consistent with the literature were obtained.

This pathology may limit itself in a period ranging from 6 months to 2 years, but in some patients, the symptoms may be permanent, resistant to treatment[17,18]. In our study, the average duration of symptoms was 166 days and the duration of hospitalization was 96 days. Since not all of the patients included in the study had long-term follow-up results, it would not be appropriate to make a correct interpretation about the duration of the symptoms. In addition, since our study was retrospective, there is a possibility that patients may be mistaken about the duration. There may be many reasons for the long first application to the hospital. Difficulty in accessing health services (such as financial difficulties, geographical difficulties, transportation problems), adoption of alternative non-scientific methods instead of modern medicine due to sociocultural factors, and ignoring the current disease can be counted as a few of these reasons.

Lateral epicondylitis is common in work that requires force and repetitive movements[17,19]. In this context, it can be said that lateral epicondlitis is common in occupational groups where repetitive and demanding jobs are performed. If we give an example from one of the models advocated in tendinitis pathophysiology, as force is applied to the tendon, cross connection and collagen accumulation increase in the tendon[20]. Tendons can easily stretch in response to gradually increasing force. During this time, multiple micro tears can cause degenerative changes in the tendon. As a result, tendinosis occurs[17,19]. In our study, it was found that it is more common in those who require force and do repetitive work, as well as housewives and those dealing with animal husbandry as a profession. In order to scientifically say that lateral epicondylitis is common in animal husbandry as a profession group, further and comprehensive studies are needed. Since the work was performed according to the occupational groups, varies depending on the degree of use of technology in the business line, and the sophistication of this technology differs in many parts of the world. Besides the place of technology in the business line, regional and cultural differences can also change the way people work in the business line.

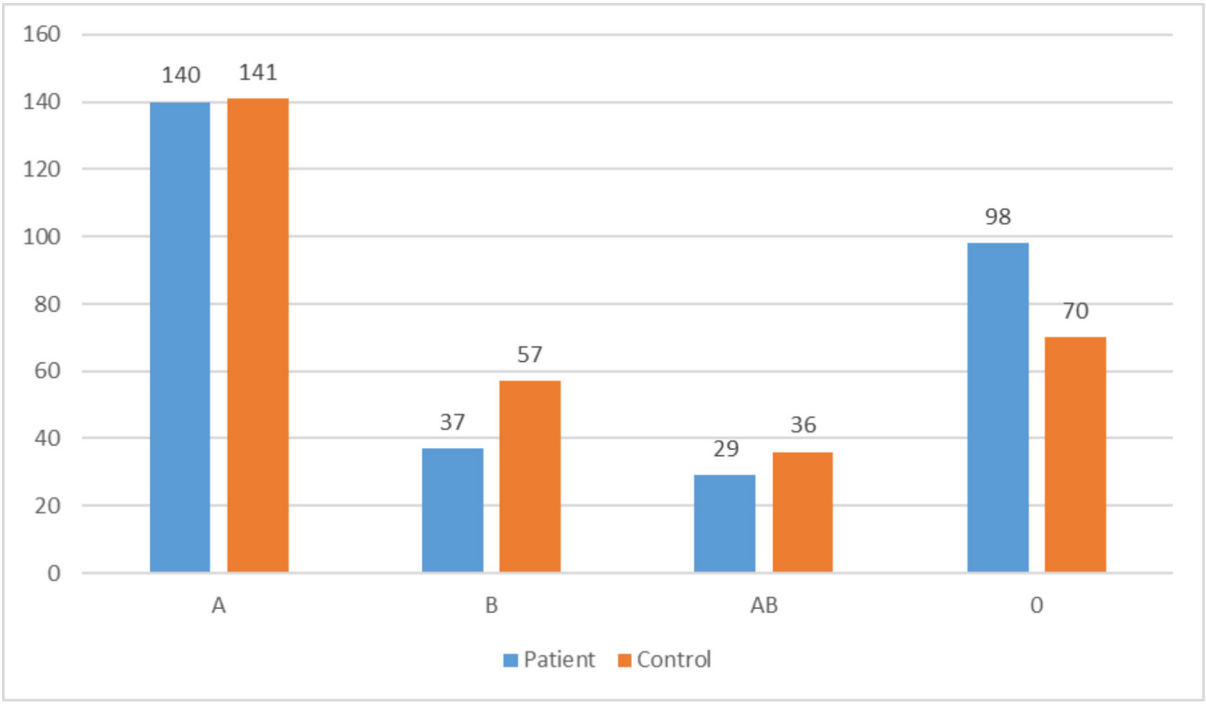

Figure 5. The distribution of the patient and control groups according to their blood groups.

In addition, we think that the reason why lateral epicondylitis is common among housewives in our study is due to the fact that women assume a different social role in the region where the study is performed, depending on housework, child care and cultural habits. In connection with this, it was observed in our study that women in the patient group had more children and the youngest child age was significantly lower. No similar evaluation has been made in the literature regarding this before. The reason for this situation can be explained by the fact that the natural needs of the child are met only by the mother depending on the cultural and regional habits and the workload of the mother at home increases exponentially with the increase in the number of children.

In addition to the importance of exposure to microtraumas in the formation of tendinitis, factors that may cause problems during the recovery period are also important. Smoking can impair the blood circulation of the tendons, which negatively affects the recovery period after tendon injuries[1]. Although there are different opinions about smoking in the literature[1,14,18], we found a significant relationship between cigarette exposure and lateral epicondylitis in our study. When we look at the literature, there are publications indicating that there is no significant relationship between alcohol consumption and lateral epicondylitis[1,10,17]. In our study, no significant relationship was found between alcohol and lateral epicondylitis. However, we think that, depending on the religious belief and sociocultural structure of the society in which the study was conducted, accurate information about alcohol consumption may not be provided. Therefore, it would not be correct to comment on alcohol with the data in our study.

While many factors can facilitate the formation of lateral epicondylitis, we can count the presence of some additional diseases in this group. Experimental and clinical studies[8] have demonstrated that there is a connection between hyperglycemia due to diabetes and tendon degeneration. Besides publications stating that there is a significant relationship between diabetes and lateral epicondylitis, there are also studies[8,10] stating that there is no relationship between them. In this sense, there is no consensus in the literature. In our study, De Quervain's tenosynovitis, DM and carpal tunnel syndrome (CTS) were significantly common in the patient group. However, there are limited studies[21-23] in the literature on the connection between de Quervain's tenosynovitis and CTS and lateral epicondylitis. Detailed studies are needed in larger patient groups related to this.

Although many factors are mentioned in the etiopathogenesis of lateral epicondylitis, the relationship between blood groups and lateral epicondylitis has not been mentioned in the literature. There are studies[24,25] in the literature comparing blood groups with trauma-related diseases. In a study[24] investigating the relationship between proximal femur fracture and blood type, no association was found. No association was found between Achilles tendon rupture and blood type association[25]. We think that the reason for this is that the etiology is mostly related to trauma. To generalize the subject a little more, there are very few publications in literature examining the relationship between blood group and tenosynovial disease. Publications[26-28] examining the relationship between Achilles tendon rupture or Achilles tendinitis and blood groups are just a few. In addition, rotator cuff tears and blood type relationships were also examined[29]. The relationship between blood groups and tenosynovial disease has not been fully elucidated. Because the *ABO* gene encodes transferases, some researchers[26] have suggested that different enzymes produced by the *ABO* gene determine not only the structure of glycoprotein antigens on red blood cells, but also the structure of some glycoproteins found in tendons. N-acetylgalactosamine level, which is a component of ABH antigens, is necessary for the balanced composition of bone, cartilage and connective tissue matrix, and it has been found[30] that the level of N-acetylgalactosamine transferase activity is low in individuals with blood type 0. In addition, there are researchers[27,28] who state that there is no direct link between tendon pathologies and *ABO* blood group antigens. These investigators[27,28] have proposed that other genes, closely linked to the *ABO* gene on the tip of the long arm of chromosome 9q32-q34 (TN-C, is located on chromosome 9 with location of the cytogenic band at the 9q33) and the *Col5a1* gene located in the 9q34.3 band of chromosome 9, which encode for components of the extracellular matrix, are more likely to be associated with Achilles tendon pathology. In another opinion, attention was drawn to the change in vWF(von Willebrand factor) level according to *ABO* blood group in the etiopathogenesis of the relationship of tenosynovial diseases with blood group. One study found that *ABO* blood group and vWF level varied and individuals with 0 blood group had an average of 25-30% lower vWF antigen levels compared to

people from other blood groups. Low vWf level can lead to bleeding tendency and bleeding disorders[31]. This bleeding disorder can also form the basis for various tenosynovial diseases.

In our study, the control group and the patient group diagnosed with lateral epicondylitis were compared. Samples were taken from the same population in both groups. Statistically significant differences between the two groups were examined. In our study, blood group was significantly higher in 0 patient group. Therefore, we concluded that blood group 0 may be a risk factor for lateral epicondylitis. The distribution of *ABO* and rhesus factor D (RhD) blood groups varies all over the world[24]. Although the distribution of blood groups in the population is different in studies conducted in different regions, the distribution of blood groups in the patient and control groups is important. For this reason, we think that similar results will be obtained with our study, since the patient and control groups may show similar distribution in studies conducted in different regions.

However, this hypothesis needs to be tested with further studies in larger patient groups at the cellular and genetic level. Considering the limitations of our study, further prospective studies are needed.

Conclusions

In our study, it was concluded that individuals of advanced age, short stature, obese, requiring strength and performing repetitive movements were at risk. In addition, housewives and livestock workers, mothers with many children and mothers with small children are also at risk. The presence of additional pathologies such as DM, de Quervain's tenosynovitis and CTS has been shown to be associated with lateral epicondylitis.

A result that we think is important has not been mentioned before in the literature. We concluded that there is a relationship between 0 blood type and lateral epicondylitis.

Conflict of Interest
The Authors declare that they have no conflict of interests.

Ethics Approval
The study was approved by the Ethics Committee of Muş Alparslan University (number E-10879717-050.01.04-2579).

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None.

Availability of Data and Materials
The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Authors' Contributions
Conceptualization: AK. Data collection: İU. Data analysis: İU. Draft: AK. Review and editing: İU. All authors read and approved the final manuscript.

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Informed Consent
Patient informed consents were obtained.

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