



Orthopedic Evaluation of Skiing Injuries in Erzurum Palandöken Ski Center

Erzurum Palandöken Kayak Merkezi Kayak Yaralanmalarının Ortopedik Açıdan Değerlendirilmesi

Fatma Cakmak¹, Halil Sezgin Semis²

¹Erzurum Private Buhara Hospital, Department of Emergency Medicine, Erzurum, Turkey

²Erzurum Private Buhara Hospital, Department of Orthopedics and Traumatology, Erzurum, Turkey

Abstract

Aim: To determine the demographic and clinical characteristics of patients who presented to our emergency department with orthopedic injuries due to winter sports.

Material and Method: This study was retrospectively conducted in the winter seasons between 2018 and 2020. The patients' age, gender, orthopedic injury localization, treatment applied for the injury, and injury patterns were examined. The findings obtained were statistically analyzed.

Results: In this study, a total of 881 patients, 311 (35.4%) female and 570 (64.6%) male, were evaluated. According to orthopedic localization, most patients (n=255, 28.6%) had knee injuries. Soft tissue trauma was detected in 519 (58.9%) of the patients. The knee injuries did not significantly differ according to gender (p=0.852).

Conclusion: During winter sports, injuries occur mostly in the lower extremity and knee area. Injuries related to winter sports can be reduced with the use of appropriate winter sports equipment and ski training.

Keywords: Winter sports, skiing, snowboarding, sports injuries, trauma

Öz

Amaç: Bu çalışmada kış sporları nedeni ile ortopedik yaralanması olup acil servisimize başvuran hastaların demografik ve klinik özelliklerini belirlemeyi amaçladık.

Gereç ve Yöntem: Bu çalışma 2018-2020 tarihleri arasında kış sezonunda retrospektif olarak yapıldı. Hastaların yaş, cinsiyet, ortopedik yaralanma bölgesi, yaralanmasına yönelik tedavileri, yaralanma şekilleri incelendi. Elde edilen bulgular istatistiksel olarak analiz edildi.

Bulgular: Çalışmamızda n:311 (35.4%) kadın ve n:570 (64.6%) erkek hasta olmak üzere toplam 881 hasta değerlendirildi. Ortopedik lokalizasyonuna göre hastalarda 255(%28.6), en fazla diz yaralanması tespit edildi. Hastaların 519 (%58.9)'una yumuşak doku travması tanısı konuldu. Diz yaralanmasının cinsiyetlere göre farkı yoktu (p=0.852).

Sonuç: Kış sporu yaralanmalarında en fazla alt ekstremitte ve diz bölgesinde yaralanma olmaktadır. Uygun kış sporu ekipmanlarının kullanılması ve kayak eğitimlerinin alınması ile kış sporlarında yaralanmaları azaltabiliriz.

Anahtar Kelimeler: Kış sporları, kayak, snowboard, spor yaralanmaları, travma



INTRODUCTION

Winter sports are one of the sports activities with an increasing prevalence across the world. Skiing, sledding, and snowboarding are popular winter sports.^[1] Due to their fast nature, they involve a risk of injury. As the number of people engaged in winter sports increases, the rate of presentation to health institutions due to related injuries also increases, but the exact number remains unclear.^[2] According to the European Injury Data Base, every year, 300,000 skiers and snowboarders are treated for injuries in Europe, which has a population of 500 million.^[3]

Skiers in winter sports can injure not only themselves but also those skiing around them. The reasons for this include skiing experience, unknown track, and non-personalized ski equipment.^[4] The most common cause of skiing injuries is falling. As a result, lower extremity, upper extremity, vertebral, and head traumas are frequently seen in these patients.^[5,6]

In this study, we aimed to determine the demographic and clinical characteristics of patients who presented to our emergency department with orthopedic injuries due to winter sports in Palandoken Ski Center over three winter seasons.

MATERIAL AND METHOD

This study was retrospectively conducted in the winter seasons between 01.11.2018 and 31.03.2020. The clinical research ethics committee of Erzurum Regional Training and Research Hospital committee approved the study on 11/04/2022 with the approval number E-37732058-514.99.

All individuals with winter sports injuries, who were aged over five years and were not pregnant, were included in the study. The same patient's ski injury at different times was also included in the study. Patients without orthopedic injuries were excluded from the study. At the time of the study, Palandoken Ski Center consisted of four tracks. It was determined that a total of 224,657 people stayed in the accommodation facilities within the center and used the ski tracks over the three winter seasons. However, the number of patients using the track facilities in a day could not be determined. During the same period, a total of 962 patients visited the emergency department due to winter sports injuries. Eighty-one of these patients had no orthopedic injury, and therefore were excluded from the study. The remaining 881 patients with orthopedic injuries were included in the sample.

Patients that presented to the emergency department were screened through the hospital automation system and patient files. Those with the same identity information according to both records were considered as a single presentation. The patients' age, gender, localization of orthopedic injury, treatments applied, and mode of injuries were recorded. The pathologies were categorized into eight

different sites according to their orthopedic localization: knee, shoulder, hand-wrist, foot-ankle, pelvis-hip, vertebra, elbow, and forearm. The mode of injury was evaluated as falling or hitting.

Statistical analysis was performed using SPSS software version 25.0 (IBM Corp., Armonk, New York, USA). The distribution of variables was evaluated for normality using the Kolmogorov-Smirnov test. Descriptive statistics were given as frequency (n) and percentage (%) values for categorical variables. For 2x2 comparisons between categorical variables, the Pearson chi-square test was used if the expected value was >5, the chi-square Yates test if 3-5, and Fisher's exact test if <3. For comparisons greater than 2x2 between categorical variables, the Pearson chi-square test was used when the expected value was >5 and the Fisher-Freeman-Halton test when it was <5. The statistical significance level was taken as $p < 0.05$.

RESULTS

A total of 881 patients, 311 (35.4%) female and 570 (64.6%) male, were included in the study. The median age of the patients was 29.4 (minimum: 5-maximum: 67) years. Of the patients, 695 (77.8%) had been injured when skiing and 186 (21.2%) when snowboarding. The remaining demographic data of the patients are detailed in **Table 1**.

When the pathologies were categorized according to their orthopedic localization, knee injuries were most common, detected in 252 (28.6%) patients. This was followed by hand-wrist injuries in 247 (28.0%) patients, shoulder injuries in 132 (15.0%), foot-ankle injuries in 100 (11.3%), pelvis-hip injuries in 55 (6.2%), vertebral injuries in 39 (4.4%), elbow injuries in 35 (4.1%), and forearm injuries in 21 (2.4%) (**Table 1**).

When the diagnoses of the patients were evaluated, 519 (58.9%) patients were diagnosed with soft tissue trauma, 328 (37.2%) with bone fractures, and 34 (3.9%) with joint dislocation (**Table 1**).

Simple non-invasive treatments were performed in 740 (83.9%) patients with orthopedic injuries. Dressing was applied to 47 (5.3%) patients, plaster-splint to 263 (29.9%) patients, bandage to 147 (16.6%) patients, and medical treatment to 283 (32.1%) patients. Surgical treatment was undertaken in 141 (16.1%) patients after necessary interventions (**Table 1**). According to orthopedic localization, hand-wrist injuries most required surgical treatment ($n=28$, 19.8%).

When the orthopedic injury sites were evaluated according to gender, 83 women and 169 men had knee injuries, with no statistically significant difference between the two groups ($p=0.852$). There were hand-wrist injuries in 80 women and 167 men, indicating no statistically significant difference according to gender ($p=0.846$). There was also no gender difference in the remaining orthopedic injury regions (**Table 2**).

Table 1: Patients' demographic characteristics

Variables	n=881 (100%)
Age (median, min-max)	29.4 (5-67)
Gender	
Female	311 (35.4)
Male	570 (64.6)
Time of injury	
08:00-12:00 hours	118 (13.2)
12:01-16:00 hours	399 (45.3)
16:01-20:00 hours	346 (39.6)
20:01-07:59 hours	18 (1.9)
Injury month	
December	101 (11.5)
January	152 (17.3)
February	425 (48.2)
March	203 (23.0)
Type of winter sport	
Ski	695 (77.8)
Snowboard	186 (21.2)
Injury site	
Knee	252 (28.6)
Hand-wrist	247 (28.0)
Shoulder	132 (15.0)
Foot-ankle	100 (11.3)
Pelvis-hip	55 (6.2)
Vertebra	39 (4.4)
Elbow	35 (4.1)
Forearm	21 (2.4)
Diagnosis	
Soft tissue trauma	519 (58.9)
Bone fracture	328 (37.2)
Joint dislocation	34 (3.9)
Treatment applied	
Dressing	47 (5.3)
Plaster-splint	263 (29.9)
Bandage	147 (16.6)
Medical treatment	283 (32.1)
Surgery	141 (16.1)

Table 2: Evaluation of injury sites by gender

Injury site	Female (n=311)	Male (n=570)	p
Knee	83	169	0.852
Hand-wrist	80	167	0.846
Shoulder	47	85	0.286
Foot-ankle	37	63	0.542
Pelvis-hip	15	40	0.652
Vertebra	14	25	0.147
Elbow	12	23	0.185
Forearm	8	13	0.252

DISCUSSION

In this study, patients with orthopedic injuries who presented to the emergency department with winter sports injuries were evaluated according to epidemiology and injury sites. It was determined that 224,657 people stayed

at the Palandoken Ski Center over the three winter seasons, and 962 (0.42%) people were injured. Orthopedic injuries were detected in 881 (91.5%) of these patients. When the literature is examined, the incidence of injuries related to winter sports is reported to be approximately 2-3%.^[7-9] In our study, injuries were detected in 0.42% of the individuals using the accommodation facilities of the ski center. We consider that this lower rate in our study is related to these facilities also being used by holidaymakers that do not engage in winter sports.

According to the literature, there is no significant difference between genders in terms of injuries in individuals exposed to skiing injuries; however, the rate of injuries is higher in men.^[10,11] In a study conducted in Finland, 35 (57.4%) of the patients with skiing injuries were found to be male, and 25 (42.6%) female.^[10] In our study, similar to the literature, orthopedic injuries were more common in men.

Falls are the most common cause of injury when skiing due to various factors, such as uneven ground, melted or icy snow, and speed. In the literature, the most common cause of injury in skiing has been reported as falling.^[12,13] In our study, we also determined that the mode of injury was mostly falling. We consider that this is related to not only the characteristics of the track but also the skiing experience of individuals.

Studies have reported that more than 50% of winter sports injuries involve the lower extremity, followed by the upper extremity.^[10-12,14] This has been attributed to the lower extremity being under the control of the ski, board, or sled during winter sports activities, and thus being exposed to more physical stress.^[13] In a study conducted by Gür et al., the rates of upper and lower extremity injuries were determined as 31.9% and 30.9% respectively among individuals engaging in winter sports.^[15] In our study, the most orthopedic injury localization was found to be the lower extremity, and the most common site of injury was the knee.

In most studies, it has been stated that fractures and sprains mostly occur as a result of skiing injuries in individuals performing winter sports.^[16,17] In a study conducted in Antarctica, Cattermole et al. reported that the most common type of injury was sprains with a rate of 62.7%, while the rate of fractures remained at the level of 15%.^[18] In another study, Gür et al. determined that 55% of patients with winter sports injuries were diagnosed with soft tissue trauma and 33.5% with fractures.^[15] In the current study, similar to the literature, soft tissue trauma was the most common diagnosis, followed by bone fractures.

Limitations

Among the limitations of the study are the inclusion of only orthopedic injuries in the sample and absence of the evaluation of other pathologies in winter sports injuries. Another limitation is that the study was conducted in a single center.

CONCLUSION

Most winter sports injuries affect the lower extremity and knee region. Winter sports injuries can be reduced with the use of appropriate equipment and ski training.

ETHICAL DECLARATIONS

Ethics Committee Approval: The clinical research ethics committee of Erzurum Regional Training and Research Hospital committee approved the study on 11/04/2022 with the approval number E-37732058-514.99.

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

- Kim S, Endres NK, Johnson RJ, Ettliger CF, Shealy JE. Snowboarding injuries: trends over time and comparisons with alpine skiing injuries. *Am J Sports Med.* 2012;40:770-6.
- Allen JB. *From Skisport to Skiing: One Hundred years of an American Sport, 1840-1940.* Amherst: University of Massachusetts Press; 1996.
- Brügger O, Bianchi G, Schulz D, Kisser R, Rogmans W. Snow-sport helmet: injury prevention, rate of wearers and recommendations. Bfu-Swiss Council for Accident prevention. 2010 erişim adresi: http://www.bfu.ch/PDFLib/1383_74.pdf erişim tarihi: 23.09.2013.
- Hagel BE, Goulet C, Platt RW, et al. Injuries among skiers and snowboarders in Quebec. *Epidemiology.* 2004;15(3):279-86
- Deady LH, Salonen D. Skiing and snowboarding injuries: a review with a focus on mechanism of injury. *Radiol Clin North Am.* 2010;48(6):1113-24.
- Hunter RE. Skiing injuries. *Am J Sports Med.* 1999; 27(3): 381-9.
- Ekeland A, Rødven A, Heir S. Injury Trends in recreational skiers and boarders in the 16-year Period 1996-2012. In: Scher I, Greenwald R, Petrone N, editors. *Snow Sports Trauma And Safety.* Champaign: Springer; 2017.
- Özen G, Yılmaz E, Koç H, Akalan, C. An epidemiological investigation of skiing injuries in Erciyes Ski Centre. *PSAM 2014-probabilistic safety assessment and management.* 2017;52(2):51-62.
- Ekeland A, Rodven A. Injuries in Norwegian Ski Resorts the Winter Seasons of 2005 und 2006. *J ASTM Int.* 2008;5(6):1-6
- Shea KG, Archibald-Seiffer N, Murdock E, et al. Knee injuries in downhill skiers: a 6-year survey study. *Orthop J Sports Med.* 2014;2(1):1-6.
- Stenroos AJ, Handolin LE. Alpine skiing injuries in Finland-a two-year retrospective study based on a questionnaire among ski racers. *BMC Sports Sci Med Rehabil.* 2014;6(1):9.
- Çevik Y, Kavalcı C, Ülke E. Kayak yaralanmalarının retrospektif analizi. *Journal of Academic Emergency Medicine/Akademik Acil Tıp Olgu Sunumları Derg* 2010;9(1):45-8.
- Aslan Ş, Aydınlı B, Uzkeser M, et al. Skiing injuries in Palandöken Ski Center: 156 cases. *Eur J Gen Med.* 2007;4(1):1-4
- Asikainen P, Lütthje P, Järvinen M, et al. Downhill skiing injuries and their cost at a Finnish skiing area. *Scand J Med Sci Sports.* 1991;1(4):228-31
- Gur A, Celik BK, Tekin E, Ozdal E, Ozlu I, Bilgili MA. Clinical features of winter sports injuries: A prospective single center study. *J Res Clin Med* 2022;10(1), 2-2
- Costa-Scorse B, Hopkins WG, Cronin J, et al. The utility of two national injury databases to evaluate snow-sports injuries in New Zealand. In: Scher IS, Greenwald RM, Petrone N, editors. *Snow Sports Trauma and Safety.* Champaign: Springer; 2017.
- Mirhadi S, Ashwood, N, Karagkevrekis B. Review of snowboarding injuries. *Trauma.* 2015;17(3);175-80
- Cattermole TJ. The epidemiology of skiing injuries in Antarctica. *Injury.* 1999;30(7):491-5.