Original Article

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From the White Slopes to the Emergency Department: An Analysis of Winter Sports Traumas in Kars

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Abstract

Background: Winter sports inherently possess dynamics that can lead to physical traumas and injuries. In this study, we aimed to investigate the injury patterns among patients admitted to the emergency department due to winter sports-related injuries, and to analyze how these types of injuries vary according to the patients' use of protective equipment and Body Mass Index (BMI).

Methods: This retrospective, single-center study was conducted with trauma patients admitted to the emergency department during the 4-month winter season when skiing and snowboarding are actively practiced. The patients' age, gender, BMI, type of sport, anatomical region of injury, radiological imaging results, protective equipment utilization, and treatment outcomes were analyzed using hospital records.

Results: In the study, which included a total of 43 patients, it was observed that 65.1% (n=28) of the participants had a normal BMI. Based on the radiological imaging performed due to the injuries, no orthopedic pathology was detected in 55.8% (n=24) of the patients. Fractures were observed in 75% (n=12) of the skiing group. The overall rate of protective equipment use among the study population was approximately 79%. More than half of the patients (51.2%) were discharged as outpatients following simple medical interventions in the emergency department. It was determined that fractures detected in radiological imaging were significantly more common among younger individuals ($p<0.05$).

Conclusion: In winter sports-related injuries, young people, especially those under 30, are at high risk for bone fractures. The use of protective equipment is effective in reducing the severity of emergency department presentations.

Keywords: Winter sports, Injuries, Emergency department, Protective equipment.

Introduction

Winter sports (skiing and snowboarding) are among the widely practiced physical activities in our country, driven by an increasing interest in recent years. Skiing and snowboarding, in particular, are preferred for both recreational and sporting purposes. However, due to high speeds, variable terrain conditions, and the inherent risk of falling, these sports are closely associated with traumatic injuries (1-3). Factors such as young age, female gender, lower skill levels, lack of protective equipment, and the surface characteristics of the slopes stand out as prominent conditions that increase the risk of injury (1,3,4). Injury patterns have evolved over time. Notably, with the widespread adoption of carving skis since the 2000s, significant increases in certain upper extremity injuries have been reported (5). Given that carving skis facilitate higher speeds and sharper turning capabilities, falls often result in higher kinetic energy, which may explain this trend (6). Conversely, since the technological evolution in snowboard equipment has been relatively limited, the distribution of injuries in this sport has remained more stable over time (5).

Although safety measures on ski slopes have increased, injuries continue to occur. The use of personal protective equipment (particularly helmets and wrist guards) has proven effective in preventing sports injuries. In snowboarders especially, the use of wrist guards significantly

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reduces the incidence of wrist fractures (7,8). However, the utilization rates of these equipments can vary based on factors such as age, gender, level of sporting experience, and individual safety awareness. In Turkey, particularly in the Eastern and Central Anatolia regions, skiing and snowboarding are widely practiced due to favorable natural conditions and developing ski resorts. Nevertheless, academic studies evaluating the epidemiology and characteristics of traumas associated with these sports remain limited (9, 2). This deficiency creates a significant gap in both the development of local health policies and the planning of preventive strategies. The objective of our study is to systematically analyze the data of individuals who presented to the emergency department due to trauma sustained while skiing or snowboarding at a ski resort located in eastern Turkey (Sarıkamış). The study aims to conduct a comparative analysis with existing literatures by evaluating the relationships between injury patterns and variables such as the type of winter sport, skill level, and the use of protective equipment.

Materials and Methods

Study Design and Participants

Ethical approval for this study was obtained from the Non-Interventional Clinical Research Ethics Committee of Kafkas University Faculty of Medicine (Decision No: KAÜ-TFEK 2025/05/16, Date: 28.05.2025). This research, conducted between December 1, 2024, and April 1, 2025, covering the winter sports season, utilizes a single-center, retrospective observational design. The study evaluated patients who presented to the emergency departments of hospitals near Sarıkamış ski resort, a leading center for winter tourism, with injuries sustained while skiing or snowboarding.

Inclusion criteria required patients to have sustained trauma during skiing or snowboarding and to present with symptoms related to acute trauma at the time of admission. Individuals exposed to non-sports-related winter traumas (e.g., falls while walking on ice), cases with incomplete data, patients who did not require any radiological imaging in the emergency department, and children under 8 years of age were excluded from the study.

Data Collection Process

Data collection was conducted by the investigating physicians working in the respective hospitals through a retrospective review of hospital records and patient files. Demographic information such as age, gender, height, weight, and body mass index (BMI) were recorded. Sport-related variables (type of sport, use of protective equipment) and the specifics of the incident (mechanism of injury) were detailed. Injury regions were categorized and examined separately as head-neck, thorax, abdomen, pelvis, upper extremity, lower extremity, and lumbar region. In patients with multiple injuries, the most severely damaged anatomical region was designated as the primary injury location. Physical examination findings during the clinical evaluation, diagnostic imaging modalities used (X-ray, CT, MRI), definitive diagnoses, applied treatment approaches (conservative or surgical), and the patients' admission/discharge statuses were meticulously recorded.

Classification of Variables

Skill level was classified into three categories: beginner, intermediate-advanced, and professional. BMI was grouped according to World Health Organization (WHO) criteria as "normal" (<25 kg/m²) and "overweight/obese" (≥25 kg/m²). Protective equipment use was dichotomized into "user" and "non-user" based on the utilization of helmets and/or wrist guards. Trauma localization was recorded in subgroups corresponding to the affected anatomical region (upper extremity, lower extremity, head-neck, and trunk). Treatment was categorized as either conservative management or surgical intervention, alongside the specification of hospital admission or discharge status.

Statistical Analysis

To evaluate the statistical power of the study, a post-hoc power analysis was conducted using G*Power software. The analysis was based on the difference between age groups regarding the detection of radiological fractures, which served as the primary endpoint of the research (independent samples t-test). Utilizing the data from a total of 43 patients included in the study (n1=16 in the fracture group, n2=27 in the non-fracture group), and assuming a Type I error rate (α) of 0.05 and an effect size (Cohen's d) of 0.85, the statistical power of the study (1-β) was calculated to be 80.1%. This value indicates that the current sample size possesses sufficient power to detect statistically significant differences.

The collected data were analyzed using SPSS version 2022 software. Mean, standard deviation, median, percentage, and frequency values were utilized for descriptive statistics. The relationships between categorical variables were analyzed using the Chi-square test. The independent samples t-test was applied for parametric variables, and the Mann-Whitney U test was used for non-parametric variables. A p-value of <0.05 was considered statistically significant.

Results

The study was completed with a total of 43 patients who met the inclusion criteria. The mean age of the patients

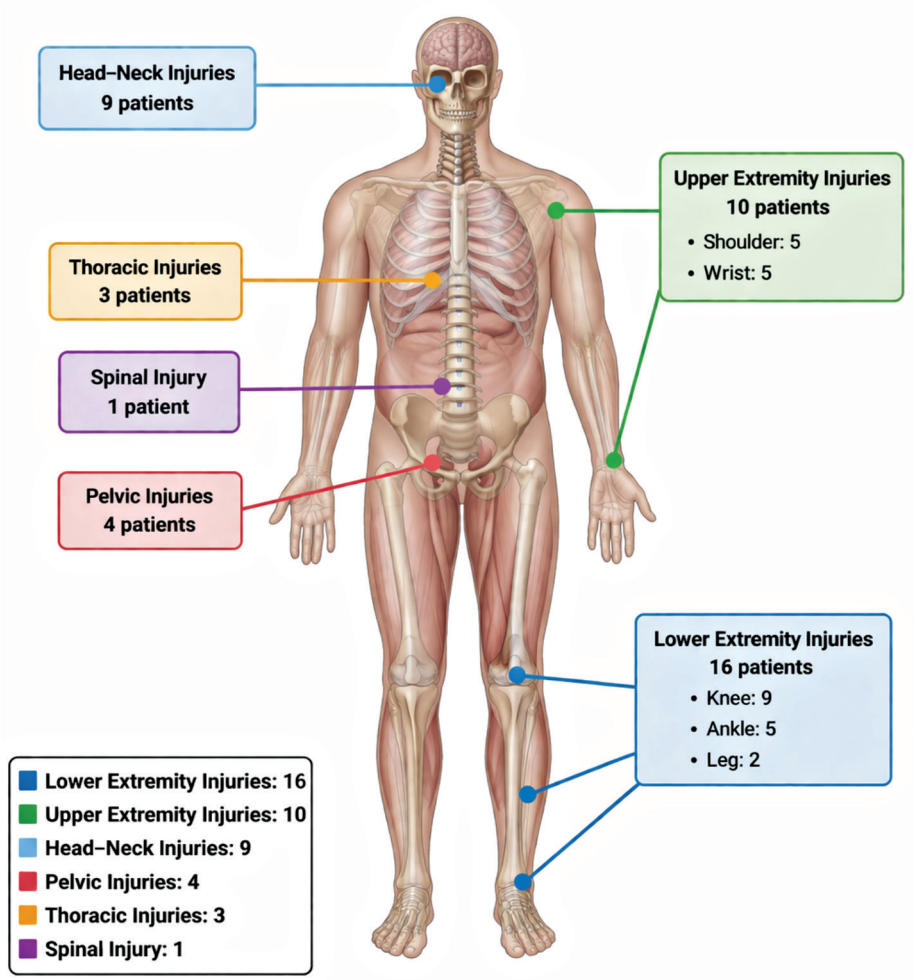

Figure 1. Number and locations of injuries.

was 26.13±10.20 years (range: 9-45 years); 60.5% (n=26) of the patients were male, and 39.5% (n=17) were female. Regarding BMI status, 65.1% (n=28) of the patients were in the normal weight category, while 34.9% (n=15) were classified as obese. When examining the types of sports, 65.1% (n=28) of the patients were injured while skiing and 34.9% (n=15) while snowboarding. Although the majority of the injured skiers (n=19) were male, this finding was not statistically significant. An analysis of the injury locations revealed lower extremity injuries in 16 patients (9 knee, 5 ankle, 2 leg), upper extremity injuries in 10 patients (5 shoulder, 5 wrist), head-neck injuries in 9 patients, pelvic injuries in 4, thoracic injuries in 3, and a spinal injury in 1 patient (Figure 1).

Following radiological imaging in the emergency department, no pathology was detected in 55.8% (n=24) of the patients, whereas fractures were identified in 37.2% (n=16) and dislocations in 7.0% (n=3). An evaluation of protective equipment usage showed that 62.8% (n=27) of the patients used helmets and goggles. While 16.3% (n=7) of the patients were fully equipped, 20.9% (n=9) used no protective gear whatsoever. Notably, 83% of the patients who presented with no pathology on radiological imaging were using at least one piece of protective equipment.

Regarding patient outcomes following emergency department evaluation, more than half (51.2%) were discharged as outpatients after simple medical interventions (such as wound dressing and analgesia). Approximately 81% of these discharged patients had utilized protective equipment. The proportion of patients with fractures and/or dislocations who were treated with bandages or splints in the emergency department was 20.9% (n=9). Conversely, 16.3% (n=7) of the patients were taken directly to surgery from the emergency department, and 11.6% (n=5) were admitted to the ward strictly for clinical observation. The vast majority (71.4%) of the patients who required hospital admission or had surgical indications fell within the normal BMI range (Table 1).

No statistically significant relationship was found between gender and radiological findings. Similarly, no significant relationship could be established between sport types and injury severity (the fracture rate detected in skiers was 75%, compared to 25% in the snowboard group; however, $p>0.05$). Likewise, the difference between BMI groups and upper extremity injury rates (70% normal weight, 30% obese) did not reach statistical significance. In contrast, it was observed that 75% of all detected fracture cases were within the young population under 30

Table 1. Demographic and Clinical Data of the Cases

Variables	Subgroups	n	%
Age (Years)	Mean ± SD	26.13 ± 10.20	-
Gender	Male	26	60.5
	Female	17	39.5
BMI Status	Normal (<25 kg/m²)	28	65.1
	Obese (≥25 kg/m²)	15	34.9
Sport Type	Ski	28	65.1
	Snowboard	15	34.9
Anatomical Region of Injury	Lower Extremity (Knee, ankle, leg)	16	37.2
	Upper Extremity (Shoulder, wrist)	10	23.3
	Head-Neck	9	20.9
	Pelvis	4	9.3
	Thorax	3	7.0
	Spine	1	2.3
Radiological Findings	No pathology	24	55.8
	Fracture	16	37.2
	Dislocation	3	7.0
Protective Equipment	Helmet and Goggles User	27	62.8
	Fully Equipped	7	16.3
	No Equipment Used	9	20.9
Treatment / Discharge	Outpatient Discharge	22	51.2
	Elastic Bandage / Splint Application	9	20.9
	Immediate Surgical Intervention	7	16.3
	Ward Admission	5	11.6

years of age. The independent samples t-test revealed a higher prevalence of fractures on radiological imaging in the population under 30 years of age, and this finding was statistically significant ($p<0.05$). When comparing the post-injury radiological findings according to gender, orthopedic pathologies were observed at a rate of 47% in females (7 fractures + 1 dislocation) and 42.3% in males (9 fractures + 2 dislocations) (Table 2).

Discussion

Lower extremity injuries are the most common reason for emergency department presentations related to winter sports. Current studies in the literature report that the knee and ankle are the most frequently injured joints. In full accordance with the literature, lower extremity injuries were the most frequently observed in our study (%37.2), followed by upper extremity and head-neck traumas, respectively. Studies conducted in similar regional centers, such as Palandöken, also emphasize the predominance of lower extremity traumas (9-11).

Table 2. Statistical Comparison of Variables

Compared Variables	Subgroups	% (n)	p
Sport Type and Fracture Rate	Ski	%75.0 (12)	
	Snowboard	%25.0 (4)	
BMI Status and Upper Extremity Injury	Normal weight	%70.0 (7)	p > 0.05
	Obese	%30.0 (3)	
Age Group and Presence of Fracture	< 30 Years	%75.0 (12)	p < 0.05
	≥ 30 Years	%25.0 (4)	
Gender and Orthopedic Pathology	Male	%42,3 (11)	p > 0.05
	Female	%47 (8)	

Among winter sports, snowboarding has been shown in several studies to cause approximately three times more injuries than skiing (12-13). However, in our study, this ratio was completely reversed; the proportion of cases with fractures on radiological imaging following skiing injuries was three times higher than that of fractures following snowboarding. We attribute this to the higher number of skiing individuals included in our study (n=28, 65.1%) compared to snowboarders (n=15, 34.9%), as well as our small total sample size (n=43). Although the number of fracture cases appeared higher in the skiing group (n=12), this difference in fracture incidence between the sport types was not statistically significant ($p > 0.05$). Additionally, the tendency of visitors to the Sarıkamış ski resort to prefer traditional skiing over snowboarding can be considered another contributing factor.

While the most frequently reported injuries in Alpine skiers involve the lower extremities, upper extremity injuries are more prominent among snowboarders. Knee and

hand injuries are predominant in skiing, whereas wrist, forearm, and shoulder injuries are more common in snowboarding (4,5,8). This difference in anatomical distribution is directly related to the execution methods of the sports, fall mechanics, and the equipment used. In skiing, the constant contact of the hands with the poles predisposes individuals to specific injuries such as "skier's thumb," whereas in snowboarding, the direct contact of the wrist and forearm with the ground during a fall determines the type of trauma (3,7). With the increasing popularity of snowboarding, a significant rise in the rates of wrist and elbow fractures, in particular, has been reported (15,16). A very recent data analysis on winter sports accidents from a high-volume trauma center in Italy confirmed that wrist fractures can often occur even at low speeds (17).

A study by Stenseth et al. demonstrated that women carry a higher risk of injury than men (18). In our study, similarly, the rate of fractures and dislocations was found to be proportionally higher in females than in males. One of the most striking findings of our study is the statistically significant relationship between the young population under 30 years of age and the radiological detection of fractures ($p < 0.05$). The fact that 75% of all detected fracture cases fall within this age group can be explained by young athletes reaching higher speeds on the slopes, having a greater tendency to take risks, and attempting dangerous maneuvers more frequently (4). On the other hand, the literature also points out that this relationship between age groups and fracture risk can vary depending on the population. Indeed, another large-scale emergency department cohort study published in 2025 reported that fractures were more commonly seen in older individuals (mean age 50) and athletes who self-identified as experienced, whereas soft tissue and ligament sprains were more prominent in the younger group (19). The high fracture rate in the young age group detected in our study may be associated with a lack of equipment or inadequate physical conditioning within our regional patient profile.

The study by Choi J et al. showed that high BMI may be a protective factor against death and disability in patients who have suffered blunt trauma (20). Another study mentioned the protective role of obesity in childhood trauma (21). In our study, it was determined that the vast majority (71.4%) of patients requiring advanced medical intervention in the emergency department and/or hospital admission were individuals with a normal BMI. Furthermore, 70% of upper extremity injuries occurred in normal-weight individuals. Contrary to the general belief that obesity may increase trauma severity, we hypothesize that the increased body fat mass in overweight individuals acts as a protective "suspension" by absorbing the high energy during a fall, thereby reducing the biomechanical stress transmitted to the bone. Although this finding did not reach statistical significance, it is worth evaluating in future studies. It is a known fact that the use of protective equipment reduces injury severity. Furthermore, the fact that 83% of the patients with no detected radiological pathology and 81% of the patients discharged with simple interventions in our study were using at least one piece of protective equipment supports the notion that helmets and similar gear directly reduce morbidity (7).

The most striking finding in our study is that 75% of the cases with fractures detected on radiological imaging were in the young population under 30 years of age. A review of the literature reveals that this result is similar to other studies conducted on the epidemiology of winter sports (8, 22). The tendency of the young population to reach higher speeds during skiing and snowboarding, and their significantly higher propensity to attempt risky maneuvers such as jumping/leaping compared to older age groups, increases the incidence of bone fractures (23,24). This situation is of great importance in terms of clinical approach strategies for patients presenting with winter sports trauma.

Our study has several limitations. The first and most important limitation is its retrospective design and relatively small sample size. Additionally, the inability to fully obtain parameters from emergency department records, such as speed at the time of injury, snow conditions of the slope, weather conditions, and the experience levels of the athletes, are among our other limitations.

Conclusion

This study demonstrates that in traumas associated with winter sports, the young population—particularly those under 30 years of age—is at a higher risk for bone fractures. Lower extremity injuries continue to be the most frequently encountered type of trauma among emergency department presentations. We hypothesized that an increased BMI might create a protective suspension effect on bone structure during high-energy falls. Furthermore, we observed a high rate of protective equipment use among patients safely discharged from the emergency department, highlighting its critical role in preventing morbidity. There is a need for multicenter and larger-scale prospective clinical studies to develop preventive strategies in this field.

References

1. Sulheim S, Holme I, Rønsen O, Bahr R. Risk factors for injuries in alpine skiing, telemark skiing and snowboarding—case-control study. Br J Sports Med. 2011;45(16):1303-1309.
2. Acar E, Demir A, Kılınç CY, Yıldırım B, Beydilli H. Kış sporları yaralanmaları. Muğla Sıtkı Koçman Üniversitesi Tıp Dergisi. 2016;3(1):29-33.

3. Davey A, Endres NK, Johnson RJ, Shealy JE. Alpine skiing injuries. Sports Health. 2019;11(1):18-26.
4. Hagel B. Skiing and snowboarding injuries. Med Sport Sci. 2005;48:74-119.
5. Chauffard A, Traverso A, Kaminski G, Elmers J, Borens O, Vauclair F. To ski or not to ski? A meta-analysis of more than 750,000 upper extremity injuries comparing skiing and snowboarding. Shoulder Elbow. 2025.
6. Alhammoud M, Racinais S, Rousseaux-Blanchi MP, Bouscaren N. Recording injuries only during winter competitive season underestimates injury incidence in elite alpine skiers. Scand J Med Sci Sports. 2020;30:1177-1187.
7. Sakamoto Y, Sakuraba K. Snowboarding and ski boarding injuries in Niigata, Japan. Am J Sports Med. 2008;36(5):943-948.
8. Kim S, Endres NK, Johnson RJ, Ettlinger CF, Shealy JE. Snowboarding injuries: trends over time and comparisons with alpine skiing injuries. Am J Sports Med. 2012;40(4):770-776.
9. Subaşı İÖ, Gür V. Recreational skiing-and snowboarding-related extremity injuries: a five-year tertiary trauma center cohort. Cureus. 2023;15(7).
10. Aslan Ş, Aydınlı B, Uzkeser M, Öztürk G, Kandiş H, Yıldırım ÖS, et al. Skiing injuries in Palandoken ski center: 156 cases. Eur J Gen Med. 2007;4(1):1-4.
11. Gur A, Celik BK, Tekin E, Ozdal E, Ozlu I, Bilgili MA. Clinical features of winter sports injuries: A prospective single center study. Journal of Research in Clinical Medicine. 2022; 10(1): 2-2.
12. Weber CD, Horst K, Lefering R, Hofman M, Dienstknecht T, Pape H-C, et al. Major trauma in winter sports: an international trauma database analysis. Eur J Trauma Emerg Surg. 2016;42(6):741-747.
13. Chen N, Yang Y, Jiang Y, Ao Y. Injury patterns in a large-scale ski resort in the host city of 2022 Winter Olympic Games: a retrospective cross-sectional study. BMJ Open. 2020;10(11):e037834.
14. Owens BD, Nacca C, Harris AP, Feller RJ. Comprehensive review of skiing and snowboarding injuries. J Am Acad Orthop Surg. 2018;26(1):e1-e10.
15. Machold W, Kwasny O, Gäler P, Kolonja A, Reddy B, Bauer E, et al. Risk of injury through snowboarding. J Trauma Acute Care Surg. 2000;48(6):1109-1114.
16. Xiang H, Kelleher K, Shields BJ, Brown KJ, Smith GA. Skiing-and snowboarding-related injuries treated in US emergency departments, 2002. J Trauma Acute Care Surg. 2005;58(1):112-118.
17. Festini Capello MP, Bizzotto N, Qordja F, Misselwitz S, Sernia C, Lachino SG, et al. Distal upper limb injuries in skiing and snowboarding: a two-season study from a high-volume trauma center in the Italian Dolomites. Medicina. 2025;61(1):787.
18. Stenseth OMR, Barli SF, Martin RK, Engebretsen L. Injuries in elite women's ski jumping: surveillance through the 2017-18 FIS World Cup season. Br J Sports Med. 2020;54:44-48.
19. Festini Capello MP, Valpiana P, Aloisi G, Cristofolini G, Misselwitz SC, Petralia G, et al. Risk factor analysis of ski and snowboard injuries during the 2023/2024 winter season: a single, high-volume trauma center database analysis. Medicina. 2025;61(1):117.
20. Choi J, Smile A, Latifi R, Gogna S, Prabhakaran K, Con J et al. Body mass index and mortality in blunt trauma: the right BMI can be protective. The American Journal of Surgery. 2020; 220(6):1475-1479.
21. Wong PW, Wong KK. Is obesity a protective factor in pediatric trauma? A retrospective review in a tertiary trauma centre over the decade. Pediatric Surgery International. 2025; 41(1): 297.
22. Dickson TJ, Terwiel FA. Injury trends in alpine skiing and snowboarding over the decade 2008-09 to 2017-18. J Sci Med Sport. 2021;24(10):1055-1060.
23. Ruedl G, Posch M, Schranz A, Niedermeier M, Greier K, Faulhaber M, et al. Are risk-taking and ski helmet use associated with an injury in recreational alpine skiing? Int J Environ Res Public Health. 2019;16(17):3107.
24. Ekeland A, Rødven A. Helmet use and self-reported risk taking in skiing and snowboarding. In: Skiing Trauma and Safety. Vol 18. ASTM International; 2011:32-43.