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Original Article

Retrospective survey of sport climbing injuries and self-care in the Gunma prefecture

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Abstract. [Purpose] This study aimed to investigate sport climbing injuries among users of a climbing gym to identify the characteristics of the injuries and preventive measures. [Participants and Methods] Participants with at least 6 months of sport climbing experience at least once a week were included in the study. They provided basic information with regard to climbing, medical history, and self-care of climbing-related injuries. [Results] Of 113 validated respondents, 85 reported a history of climbing-related injuries. The injury occurrence rate by location was highest in the fingers, followed by the wrist, shoulder and ankle, knee, and elbow. All the ankle injuries had sudden onset. Moreover, the occurrence rates of the injuries with both sudden and gradual onsets tended to be higher in the fingers and wrists. With regard to the self-care status, warming up was performed by 88.5% of the participants; and cooling down, by only 25.7%. [Conclusion] This study found a high incidence of injuries involving the fingers, wrists, and ankles, which suggests the need for prevention by self-care.
Key words: Sport climbing, Injury, Self-care

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INTRODUCTION

Sport climbing uses holds to climb an artificial wall, competing for technique, height, and speed. It is an added event for the Tokyo Olympic Games in 2020. With increasing interest in the sport, the number of climbing gyms and participants has also increased. Sport climbing challenges the participant to follow a set route using various holds, foot placement, and balancing of the center of gravity.

Sport climbing is susceptible to upper extremity injuries. Holds vary in shape and size. Upper extremity injuries due to overuse, fatigue, and unfamiliar movements occur in 57.6% to 78% of climbers, and 27.5% to 43.7% of them is finger injuries[1–3)]. Sprains and overuse injuries are common, but finger pulleys and flexor tendons may also be damaged[4, 5)].

Falling-related injuries such as fractures and lacerations have also been reported, involving areas other than the upper extremities[1, 2)].

As there are few such reports in Japan, this article aimed to investigate sport climbing injuries among users of a climbing gym, to identify the characteristics of injuries and measures for prevention.

PARTICIPANTS AND METHODS

Participants with at least 6 months of sport climbing experience at least once a week were included in the study. Approval for this study was obtained from the Koutokukai Medical Corporation Ethics Committee (approval code KH30002). We conducted a questionnaire survey after obtaining informed consent.

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The self-completed questionnaire collected data on injuries in 7 climbing gyms in the Gunma prefecture. Participants provided basic information on climbing, past medical history, and self-care of climbing injuries. Basic information included years of experience, participation in competitive events, climbing grade, and climbing locations. The retrospective survey investigated climbing-related injuries to determine timing, location, mechanism, number of rest days, and diagnosis. Injuries were classified according to International Olympic Committee (IOC) definitions[6]. Self-care questions examined the use of warming up and cooling down, as well as the time spent on self-care and the types of self-care activities.

The incidence rate by injury location was calculated from past history. Injury location was based on the IOC classification[6]. The average number of rest days was calculated as an index of injury severity. The implementation of self-care was described.

RESULTS

Table 1 shows basic respondent information. Of 145 respondents, 113 provided validated information. Of these, 91 were males and 22 were females. The average climbing grade (metric scale) for red point bouldering was 7.33–7.66, with onsite grade of 6.66–7.00. About 90% of climbing activity sites were indoors.

Of 113 validated respondents, 85 reported a history of climbing-related injuries. The circumstances and severity of injuries by location are shown in Tables 2 and 3. Of 131 injuries, the head and trunk accounted for 9.5%, the upper extremity for 62.7%, and the lower extremity for 27.8%. The injury occurrence rate by location was highest in the fingers, followed by the wrist, shoulder and ankle, knee, and elbow. When classified by type, injuries of sudden onset were most common in the fingers, followed by the ankle and wrist. Especially, all the occurrence of ankle injuries was sudden onset type. Injuries of gradual onset were most common in the fingers and shoulder, followed by the wrist, elbow, and knee. The occurrence rate of injuries with both sudden and gradual onset tended to be higher in fingers and wrists. The average number of rest days by location was highest for injuries of the ankle, followed by the knee and shoulder, but the durations were similar for all injury locations. Among injuries of sudden onset, the shoulder, knee, and ankle, in that order, accounted for a longer rest duration. Among injuries of gradual onset, the fingers, wrist, and shoulder, in that order, accounted for a longer rest duration.

The status of self-care is shown in Table 4. Warming up was performed by 88.5% and cooling down by only 25.7%. The average warm-up duration was 16.8 minutes and the average for cool-down was 16.7 minutes. Additional self-care activities included stretching and climbing of lower-grade routes.

DISCUSSION

Several studies have examined climbing-related injuries[1–3]. However, there are few reports on climbing-related injuries in Japan, and data are needed to determine preventive measures.

As in previous reports[1–3], this study also found a high incidence of injuries involving fingers, wrists, ankles, and shoulders. Fingers and wrists were involved in about 40% of all sport climbing injuries. Injuries due to falls were associated with difficult holds. However, with increased climbing activity, the risk of injuries also increases.

The rate of finger and wrist injuries of gradual onset was high. Overloading of the fingers and wrists with overtraining is one cause, but other factors include reinjury of the same location. Prevention of finger and wrist injuries is necessary, but may be difficult considering the requirements to improve the climbing grade. Therefore, it is necessary to promote appropriate rest and self-care. As note, cooling down was only performed by about 25%, and warming up by 80% or more. Self-care should include low grade tasks and stretching, and injury assessment risk should be performed with a detailed survey and examination. Icing and careful stretching are necessary for the intrinsic and extrinsic muscles of the fingers, because of the high incidence of injuries related to overuse.

Sport climbing is performed at heights above 5 m, even in indoor bouldering, and there is always a risk of falling. Previous studies also report that it involves foot, toe and ankle of all acute climbing injuries[2]. Traumatic ankle injuries are common, with severity ranging from mild sprains to fractures.

Indoor climbing gyms use buffer mats and consideration is given to safety, but the arrangement of buffer mats and appropriate falling methods should also be considered. Modern climbing shoes have attributes like downturn, the concave shape that places pressure on the toes, and the foot shortens through supination and contraction of the digits[7]. These positions tend to be a risk of foot and ankle sprain, suitable size climbing shoes should be worn. In addition, although this survey did not focus on outdoor climbing, the difficulty of ensuring safety in rocky areas should be considered, as the risk of falling is high.

To return to sport climbing after an injury, adequate rest time is important. The average duration of rest days was longer after ankle, knee, and shoulder injuries, especially when of sudden onset and of greater severity. Although the ankle can be affected by ligament injuries and fractures, the knee can sustain ligament and meniscus injuries, as can the shoulders and hips. Both internal and external risk factors must be considered, but injuries are often triggered by climbing-specific movements, as reported in multifactorial models described by Meeuvisse et al.[8] and Bahr et al[9]. Therefore, it is necessary to consider the relevance of factors associated with sport climbing-specific movements.

This study has several limitations. First, to assess the risk of climbing-related injuries, the International Climbing and Mountaineering Federation[10] recommended calculating the risk per 1,000 hours of mountain sports activity. This retrospec-

Table 1. Basic information of respondents

Age (years)		34.0 ± 10.0
Height (cm)		167.4 ± 7.2
Weight (kg)		59.0 ± 7.6
BMI		20.4 ± 3.8
Years of experience (years)		4.1 ± 4.6
Climbing location (rate)	Indoor	9.2 ± 1.1
	Outdoor	0.8 ± 1.1
Activity frequency (time/week)		3.0 ± 1.2
Activity time (hours/time)		2.8 ± 1.2

Mean ± SD.

Table 2. Injuries by anatomic location

Location		Frequency (%)		
		Sudden onset	Gradual onset	Total
Head and trunk (9.5%)	Face	1 (1.0%)	0 (0.0%)	1 (0.8%)
	Head	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Neck/Cervical spine	2 (2.0%)	0 (0.0%)	2 (1.5%)
	Thoracic spine/Upper back	1 (1.0%)	1 (3.0%)	2 (1.5%)
	Sternum/Ribs	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Lumber spine/Lower back	4 (4.1%)	3 (9.1%)	7 (5.3%)
	Abdomen	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Pelvis/Sacrum/Buttock	0 (0.0%)	0 (0.0%)	0 (0.0%)
Upper extremity (62.7%)	Shoulder/Clavicle	11 (11.2%)	7 (21.2%)	18 (13.7%)
	Upper arm	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Elbow	3 (3.1%)	6 (18.2%)	9 (6.9%)
	Forearm	1 (1.0%)	0 (0.0%)	1 (0.8%)
	Wrist	17 (17.3%)	6 (18.2%)	23 (17.6%)
	Hand	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Finger	21 (21.4%)	7 (21.2%)	28 (21.4%)
	Thumb	0 (0.0%)	0 (0.0%)	0 (0.0%)
Lower extremity (27.8%)	Hip	1 (1.0%)	0 (0.0%)	1 (0.8%)
	Groin	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Thigh	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Knee	9 (9.2%)	3 (9.1%)	12 (9.2%)
	Lower leg	3 (3.1%)	0 (0.0%)	3 (2.3%)
	Achilles tendon	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Ankle	18 (18.4%)	0 (0.0%)	18 (13.7%)
	Foot/Toe	1 (1.0%)	0 (0.0%)	1 (0.8%)
	Other	5 (5.1%)	0 (0.0%)	5 (5.1%)
	Total	98 (100%)	33 (100%)	131 (100%)

tive survey determined the incidence of injuries based on climbing history, rather than the risk of injuries per hour or per number of climbs. Second, this survey was self-completed, and therefore subject to reporting bias. Third, injuries without rest days were also counted, and those that did not correspond to established definitions or require medical attention or rest time were included. Therefore, more detailed analysis is necessary.

Conflicts of interest

None.

Table 3. Mean duration of days of rest on injury

Location		Days of rest (days)			
		Sudden onset	Gradual onset	Total	(Min – Max)
Head and trunk	Face	7.0	0.0	7.0	(0–7)
	Head	0.0	0.0	0.0	(0–0)
	Neck/Cervical spine	18.5	0.0	18.5	(7–30)
	Thoracic spine/Upper back	60.0	30.0	45.0	(30–60)
	Sternum/Ribs	0.0	0.0	0.0	(0–0)
	Lumber spine/Lower back	26.0	2.3	15.9	(0–30)
	Abdomen	0.0	0.0	0.0	(0–0)
	Pelvis/Sacrum/Buttock	0.0	0.0	0.0	(0–0)
Upper extremity	Shoulder/Clavicle	50.5	5.7	33.1	(0–360)
	Upper arm	0.0	0.0	0.0	(0–0)
	Elbow	3.3	2.3	2.7	(0–14)
	Forearm	0.0	0.0	0.0	(0–0)
	Wrist	20.1	6.2	16.5	(0–90)
	Hand	0.0	0.0	0.0	(0–0)
	Finger	11.7	20.0	13.8	(0–120)
	Thumb	0.0	0.0	0.0	(0–0)
Lower extremity	Hip	7.0	0.0	0.0	(0–7)
	Groin	0.0	0.0	0.0	(0–0)
	Thigh	0.0	0.0	0.0	(0–0)
	Knee	49.3	0.0	37.0	(0–360)
	Lower leg	7.0	0.0	7.0	(0–7)
	Achilles tendon	0.0	0.0	0.0	(0–0)
	Ankle	38.1	0.0	38.1	(0–180)
	Foot/Toe	0.0	0.0	0.0	(0–0)
	Other	0.0	0.0	0.0	(0–0)
	Total	25.9	8.1	21.4	(0–360)

Table 4. Self-care performing rate

	Rate (%)	Time (min)
Warming up	88.5%	16.7 ± 12.1
Cooling down	25.7%	16.7 ± 14.1

Mean ± SD.

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