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The Type Analysis for Safety Accident of Water Sports Happening in River

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Purpose: Recently, as the number of people who enjoy water sports life in river or lake easy to accessible are increasing, that of the patients who are injured in water sports also does gradually. We intend to investigate the type of the injured patients of water sports and the riskiness of the sports in this study.

Methods: We retrospectively looked into the medical records of the patients who were injured in water sports and visited a general hospital in Gangwondo-province from 2010 to 2015.

Results: Total 146 patients came to the hospital during six years. Patients mostly occurred at younger ages, in summer, and on holidays, rather than weekdays. The most common lesions of injuries were faces (53 patients). The most common types of injuries were contusions (62 patients), followed by fractures (32 patients) and lacerations (26 patients). The most frequent fracture sites were the upper extremities (11 patients). Most of the trauma patients were mild, but a small number of patients with aspiration pneumonia occurred and their severity was higher than trauma patients.

Conclusions: In this study, facial injuries were most frequent in water sports injuries. In the fractures, upper extremities were the most common fractured lesions. In addition, even if there is no direct trauma, aspiration pneumonia is serious, so caution should be taken with protective equipment suitable for water sports.

Keywords: Sports injuries; Aspiration pneumonia; Abbreviated injury scale

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INTRODUCTION

Water sports activities in river or lake include blob jumping, wake boarding, water skiing, banana boating, peanut boating, flying fish, water boarding, jet skiing and so on.

In recent years, the number of people enjoying water sports in Korea is rapidly increasing every year [1]. Though they would only prevail among some enthusiasts in the past, a lot of people are taking their holidays for them today. Even the number of those who go in for water sports rather than try them a couple of times has increased. Due to the increase in per capita income and the establishment of a five-day workweek, the paradigm of leisure activities has changed from the previous passive way to the diversified and advanced experience-oriented active way. In addition, the accessibility to waterfronts has also been improved by the increase in vehicle penetration and the expansion and improvement of the megalopolitan transport network. As a result, the demand for water sports has been rapidly increasing, mainly in the 20-30 age group [2]. The number of people enjoying the water sports that utilizes the inland waters as valleys, reservoirs, and rivers, of which some are in recreation grounds, has inexplicably increased for years [3].

With the rapid increase of people enjoying water sports like this, the number of patients injured in water sports and driven to the emergency room is also increasing. Accordingly, much social and economic loss have occurred [4].

However, there is no literature about the type and damage characteristics of water sports in Korea. This seems to be due to the relatively late introduction of water sports, since the people enjoying water sports are increasing in Korea, the characteristics and analysis of the injured patients will be helpful in the prevention and appropriate treatment of water sports injured patients. In our city, the place of many river amusement parks, frequently happened the patients of inland water sports. So, through the clinical study about such patients in this city, we intend to know the hazard associated with water sports activities by analysis of the injury character, the related factor and the seriousness of injury.

METHODS

Subjects

From April 2010 to October 2015, we targeted 146 patients who went to a general hospital in Gangwon-do after injured in water sports in river or lake. Accidents in the valley or swimming pool were excluded.

Methods

Among the injured patients who came to emergency room, the medical records of the patients related to water sports activities were researched retrospectively. Based on the medical charts in the emergency centers, we researched each patient's general characteristics such as sex, ages. Also the accident time, the accident place, the injury mechanism, the presence of wearing protect gear or not, the kinds of protect gear, the injury site, the degree of injury and severity were researched. Researches on the missed points were carried out by phone. To check the awareness condition in their visiting the hospital, Glasgow coma scale (GCS) was used and abbreviated injury scale (AIS) was used to confirm the severity of injuries. The AIS was designed in 1971 to objectively assess the degree of trauma in traffic accidents. It is the index of the degree of damage from 1 (minimal) to 6 (maximal) for every human anatomical lesion [5].

Based on research data, we analyzed how the injury severity has been influenced on by the sex, the age, the place, the injury mechanism and the presence of wearing the protect gear or not.

Ethics statement

This study was approved by our institutional review board (IRB No. 2016-78). The requirement for informed consent was waived by the IRB because of the observational nature of this research.

RESULTS

Frequency of patients by sex and age

During the study period, 146 patients were enrolled. 56.8% of the patients weare men and 43.2% were women. The 91% of the patients were under their forties (Table 1).

Frequency of patients by water sports type

The types of water sports were ordered in following sequences, water-skiing (24%), banana boating (22.6%), wake boarding (15.1%), blob jumping (12.3%), and riding the other boats (9.6%) (Table 1).

Protective equipment wear ratio and treatment results

91.8% of the whole patients were wearing a life jacket only, and 6.8% were wearing both a life jacket and a head gear. 56.8% of the patients returned home after treatments, followed by hospital transfers of 38.4%, hospitalization 4.8% (Table 1).

Frequency of patients by period

The number of patients visited by year was the highest in 49 patients in 2015, followed by 2013 (27 patients), 2014 (25 patients), and 2010 (24 patients) (Fig. 1). The number of patients visited by month was the highest in 79 patients in August, followed by July (27 patients), June (25 patients), May (24 patients), and September (10 patients) (Fig. 2A). 62.3% (91 patients) visited the hospital on weekends and holidays (Fig. 2B).

Table 1. Demographics and general characteristics of water sports injured patients

Variables	Value (n=146)
Sex	
Male	83 (56.8)
Age (years)	
<40	133 (91)
≥40	13 (9)
Aquatics	
Wakeboarding	22 (15.1)
Waterskiing	35 (24)
Banana boat	33 (22.6)
Peanut boat	10 (6.8)
Other boat	14 (9.6)
Blob jumping	18 (12.3)
Flying fish	9 (6.2)
Rafting	4 (2.7)
Others	1 (0.7)
Protection	
None	2 (1.4)
Life jacket	134 (91.8)
Life jacket and headgear	10 (6.8)
Outcome	
Admission	7 (4.8)
Discharge	83 (56.8)
Transfer	56 (38.4)

Values are presented as number (%).

Lesions of injury and AIS distribution

The most injured area was the face (53 patients), followed

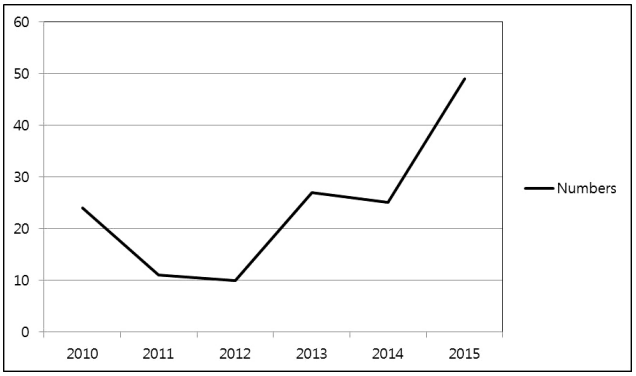

Fig. 1. Distribution of water sports-related trauma patients visit to the emergency center by year.

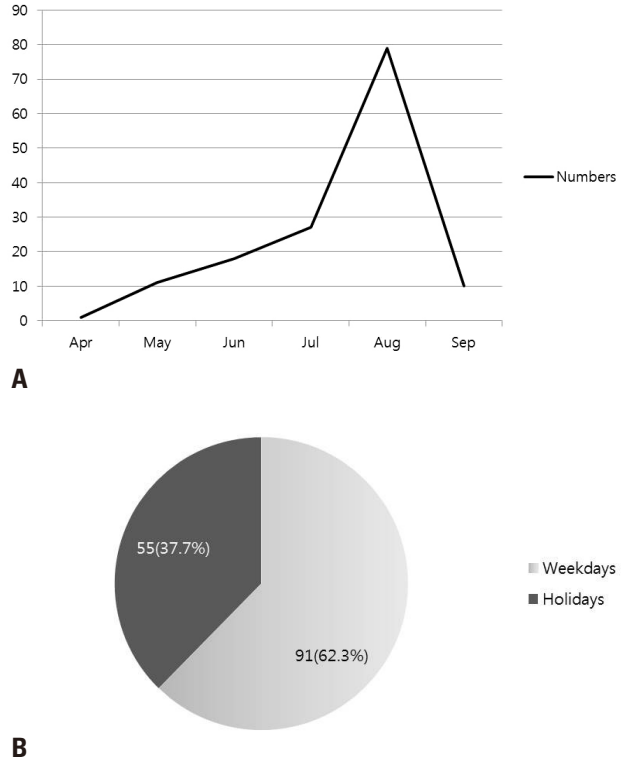

Fig. 2. Frequency of water sports-related injuries by month and week. (A) Distribution of patients by month. (B) Distributions of patints in water sports at holidays versus weekdays.

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by upper extremities (35 patients), lower extremities (26 patients), abdomen (17 patients), head (16 patients). The median AIS was the highest at the chest (1.5 points), and was the same at all points (Table 2).

Frequency of patients by type of injury

The most common types of injuries were contusions, follwed by fractures (32 patients) and lacerations (26 patients). Patients with local (otitis media) or systemic (aspiration pneumonia) inflammatory findings without direct trauma, and those with perforation of the tympanic membranes were classified as others (Table 3).

DISCUSSION

In this study, facial injuries (53 patients) were most common in water sports. The most common type was contusion (62 patients). The second most common type was fracture (32 patients), and the most common lesion of fracture was the upper extremity (11 patients). This is consistent with the report that the upper extremity fracture was the most common in some domestic studies on winter sports (alpine skiing, snowboarding) [6-8]. However, there were 16 patients with perforation of the tympanic membranes, which was clearly different from that of winter sports.

While the study of a foreign country showed male injured people were three times more than female, this study didn't show any notable difference between the number of male and female injured ones [9-12]. It seems to be due to the increase in the number of women enjoying sports. It also didn't show any significant difference in gender distribution by injury type. However, it seems that the reason for the increased proportion of women was because this study incorporated the highly accessible sports even to beginners while the previous study was confined to the

Table 2. Lesions of injury and AIS distribution

Injured lesion	Numbers	AIS median (IQR)
Head & neck		
Head	16	1 (1-1)
Neck	9	1 (1-1)
Face	53	1 (1-1)
Trunk		
Chest	14	1.5 (1-2)
Abdomen	17	1 (1-2)
Pelvis	4	1 (1-2)
Extremity		
Upper	35	1 (1-2)
Lower	26	1 (1-2)

AIS: abbreviated injury scale, IQR: interquartile range.

Table 3. Distribution of patients by type of injury

Diagnosis	Value (n=146)
Fractures	32
Face	3
Neck	2
Chest	7
Back	3
Upper extremities	11
Lower extremities	6
Lacerations	26
Scalp	4
Face	16
Upper extremities	2
Lower extremities	4
Abrasions	4
Face	1
Lower extremities	3
Contusions	62
Head	11
Face	7
Chest	9
Abdomen and pelvis	13
Upper extremities	13
Lower extremities	9
Sprains	18
Neck	7
Chest	1
Abdomen and pelvis	5
Upper extremities	2
Lower extremities	3
Dislocations	8
Upper extremities	5
Lower extremities	3
Others	30
Acute otitis media	10
Aspiration pneumonia	4
Perforation of tympanic membranes	16

sports that required some expertise, such as wakeboarding and water skiing.

Although not directly traumatic, the severity of drowning was high, because falling into the water caused infectious diseases such as aspiration pneumonia. It's easy to focus on trauma alone for a patient injured by water sports, but if falling into a lake or a river that's typically polluted in summer and drinking or absorb the water, they're prone to infection. In this study, 4 cases of aspiration pneumonia occurred, of the total 146 patients, 56.8% (83 patients) returned home, while all 4 patients were discharged after intensive care unit (ICU) treatment. It is easy to worry about trauma only when patients are caused by water sports. However, aspiration pneumonia is uncommon but may occur and its severity is high. Therefore, patients who are likely to have aspiration pneumonia should be advised to observe for long time or hospitalization. In particular, aspiration pneumonia should not be seen immediately after the aspiration of the patient, but it should be noted that the symptoms often appear only after a few hours have elapsed [13]. Sanborn et al. suggested that appropriate antibiotics should be administered as there was a risk of chronic complications due to infection from various strains when injured by water sports [14]. For example, it was reported that a 22-year-old male patient hit his ear on the water while water skiing in Texas and died of amoebic infection through his ear [15]. Due to the nature of water sports that involve polluted water, preventive actions with consideration of the possibility of infection seem to be necessary even for patients with simple trauma.

In this study, looking at the patient distribution by year, there were 24 cases in 2010, 11 cases in 2011, 10 cases in 2012, 27 cases in 2013, 25 cases in 2014, and 49 cases in 2015. The average value of the second half (2013-2015) of the six years was 33.7, three times that of the first half (2010-2012), which was 11.3.In particular, 49 patients visited to the hospital in 2015, this is more than 2.5 times the average of the previous five years (2010-2014) of 19.4, which seems to reflect the recent sharp increase the peples enjoying water sports.

By month, there were seldom patients in April (0.7%), but the number began to increase in May (7.5%) and June (12.3%) to rise remarkably in July (18.5%) and August (54.1%). This fact shows that as the temperature increases, the number of patients increases, due to the nature of water sports that need to be exposed to cold water in the outdoor. It's worth noting that the number of patients in August when work sports are in high demand was almost five times that of the other 5 months (13.4 patients), accounting for more than half of the total number of patients (54.1%).

The number of patients visited on weekends (Saturday, Sunday) and public holidays was 91 (62.3%), Considering that the average number of holidays per year during the study period was 115.2 days, the number of patients per day was 0.13 people per day on holiday which was more than 4 times of 0.03 people per day on weekdays. Possibly, this is due to the nature of water sports, which most people have to go to an amusement park in a river or lake, it is hard to do a light exercise after a week on a weekday, and we think it will be because we have to move a schedule for more than one day.

These characteristics were also reflected in the results of the medical examination. After the medical examination, only 7 (4.8%) were hospitalized in this hospital, but 83 (56.8%), returned home, and 55 (38.4%) were transferred to other hospitals. In this study, the residents of Gangwon-do were only 7.3% while most were just visiting our city for holidays and 73.5% were the residents of Seoul and Gyeonggi-do (34.4% in Seoul and 39.1% in Gyeonggi). Therefore, the transfers were rarely due to medical reasons, but in most cases, the patients went to the one in their neighbourhood. This led to limitations that made it difficult to identify the long-term prognosis of the patient.

This study was confined to a general hospital in a single area and limited in the scope and number of subjects. Future nationwide studies of patients from various hospitals are considered to be necessary. This study also had to rely entirely on the past records since it was conducted with the retrospective approach to review records, unlike the experimental approach to control multiple variables or the prospective approach to define object groups and keep track of multiple variables.

CONCLUSION

In this study, facial injuries were most frequent in water

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sports injuries. In the fractures, upper extremities were the most common fractured lesions. In addition, even if there is no direct trauma, aspiration pneumonia is serious, so caution should be taken with protective equipment suitable for water sports.

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