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Distinct features of trampoline-related orthopedic injuries in children aged under 6 years

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ABSTRACT

Introduction: Concern has been growing about trampoline-related injuries among young children. Several published policy statements have repeatedly recommended that children younger than 6 years should not use trampolines. However, few studies have investigated the injuries caused by trampoline-related accidents among young children. This study aimed to identify the distinct features of trampoline-related orthopedic injuries in children younger than 6 years.

Methods: We retrospectively reviewed the medical records of pediatric patients aged between 0 and 16 years who visited our regional emergency center due to trampoline-related orthopedic injuries between 2012 and 2015. Patients were divided into two groups: a preschool group (younger than 6 years) and a school group (older than 6 years). We compared the features of the injuries in the two groups.

Results: Among 208 patients, 108 (52%) were male and 100 (48%) were female. The mean age was 5.4 years. The preschool group accounted for 66%. There were no seasonal variations. Fractures were sustained in 96 patients (46%). The anatomical locations of injuries differed significantly between the two age groups. Proximal tibia fractures were more frequent in the preschool group than the school group (34% and 6%, respectively). Distal tibia fractures were more prevalent in the school group than the preschool group (44% vs. 13%, respectively). Surgical treatment was needed more frequently in the school group ($p = 0.035$, hazard ratio 2.52, 95% confidence interval: 1.03–6.17). Most of the injuries (82%) occurred at trampoline parks.

Conclusions: The anatomical locations of trampoline-related orthopedic injuries differed significantly between age groups. Fractures were more common around the knee in younger children and the ankle in older children.

Introduction

The growing popularity of trampolines has caused significant increases in the number of injuries associated with their use [1]. Most previous studies of this problem were descriptive and they determined the general characteristics of trampoline-related injuries in the general population [2–8]. National Health morbidity data from Australia indicates that the frequency of injuries has increased each year [6]. According to the National Electronic Injury Surveillance System in the United States, approximately 1,002,735 emergency department visits were due to trampoline-related injuries between 2002 and 2011, and more than 90% of these injuries involved children [4].

A series of policy statements published by the American Academy of Pediatrics and the American Academy of Orthopedic Surgeons (AAOS) aimed to discourage children and adolescents from using trampolines. The position statements of the AAOS recommend that children younger than 6 years should not be allowed to use trampolines. The U.S. Consumer Product Safety Commission made a similar recommendation [9]. However, there is little evidence to support prohibiting use in those aged less than 6 years. Indeed, relatively few studies have focused on the possible association between age and trampoline-related injuries. One study showed that 44 children aged younger than 6 years had a higher risk of head lacerations on mini-trampolines and lower extremity fractures on a full-sized trampolines [10]. Another study reported lower extremity fractures in five children aged less than 5 years [11].

Thus, identifying the characteristics of trampoline-related injuries in children aged less than 6 years would be beneficial for preventing further injuries and setting guidelines. To the best of our knowledge, the patterns of trampoline-related injuries in

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children aged less than 6 years have not been reported previously. In this study, we reviewed trampoline-related orthopedic injuries in children aged between 0 and 16 years. The aim of the present study was to identify the specific trampoline-related orthopedic injury patterns found in children aged less than 6 years.

Approval for this study was granted by the Institutional Review Board at Gachon University Gil Hospital.

Materials and methods

We retrospectively reviewed the medical records of patients aged between 0 and 16 years who visited a university hospital emergency department due to trampoline-related orthopedic injuries between January 2012 and December 2015. The patient characteristics of interest included age, sex, injury type (soft tissue injury or fracture), area of injury, and treatment. The family of each patient was contacted by telephone to ascertain the circumstances of the injury, including the location where the injury occurred (at home or a trampoline park), the presence of adult supervision, the number of people on the trampoline (multiple people jumping on the same trampoline), and the age of the patient relative to the other people jumping on the trampoline (youngest person jumping). All radiographs were reviewed to determine the presence and anatomical location of the fracture. The relevant institutional review board approved this study.

For analytical purposes, the patients were divided into two groups: a preschool group aged less than 6 years and a school group aged over 6 years. Statistical analyses were performed using SPSS® software (Version 18.0; SPSS Inc., Chicago, IL, USA). Analyses of continuous data were performed using the Student's *t*-test or analysis of variance. Discrete data differences were analyzed using the χ^2 test. *p*-values less than 0.05 were considered to indicate significant differences.

Results

General characteristics of trampoline injuries

Among the 226 patients, we excluded 18 patients with insufficient medical records, and thus 208 patients were included. Of 208 patients, 108 (52%) were male and 100 (48%) were female. The mean age was 5.4 years. The preschool group accounted for 66% (Fig. 1). The ankle (37%) and knee (32%) joints were injured most commonly. Fractures were sustained by 96 patients (46%). There were 54 lower extremity fractures and 42 upper extremity fractures. Overall, the distal humerus (n = 33, 34%) was the most common fracture site (Table 1). Twenty-eight fractures (29%) involved the physis, where 69% of these fractures comprised Salter–Harris type 2 injuries. A five-year-old girl suffered a radial tear of the lateral meniscus. Of 208 patients, 22 children (11%) required surgical treatment. The median hospital stay was 4 days (range, 1–17 days). There were no seasonal differences (Fig. 2).

Comparison of clinical characteristics in the preschool and school groups

Among the clinical characteristics, the anatomical locations of injuries differed significantly between the two age groups ($p = 0.010$) (Table 1). Injuries around the knee joint were most common (45%) in the preschool group, whereas ankle joint injuries were more frequent (62%) in the school group. Proximal tibia fractures occurred more frequently in the preschool group than the school group (34% vs. 6%, respectively). Distal tibia fractures were more prevalent in the school group than the preschool group (44% vs. 13%, respectively). Despite the similar incidence of fractures, surgical treatment was needed more frequently in the school group ($p = 0.035$, hazard ratio = 2.52, 95% confidence interval = 1.03–6.17). Sprain was the most commonly reported type of injury and the incidence did not differ significantly between the two groups ($p = 0.351$, hazard ratio = 1.168, 95% confidence interval = 0.656–2.080). Knee sprains occurred frequently in the preschool group and ankle sprains were common in the school group ($p = 0.001$).

Trampoline park injuries

Most of the injuries (82%) occurred at trampoline parks (Fig. 1). The presence of multiple people jumping on a trampoline was associated with 67% of the injuries, where these injuries occurred more frequently at trampoline parks than at home (69% vs. 42%, respectively; $p < 0.001$). More than half of the injured children

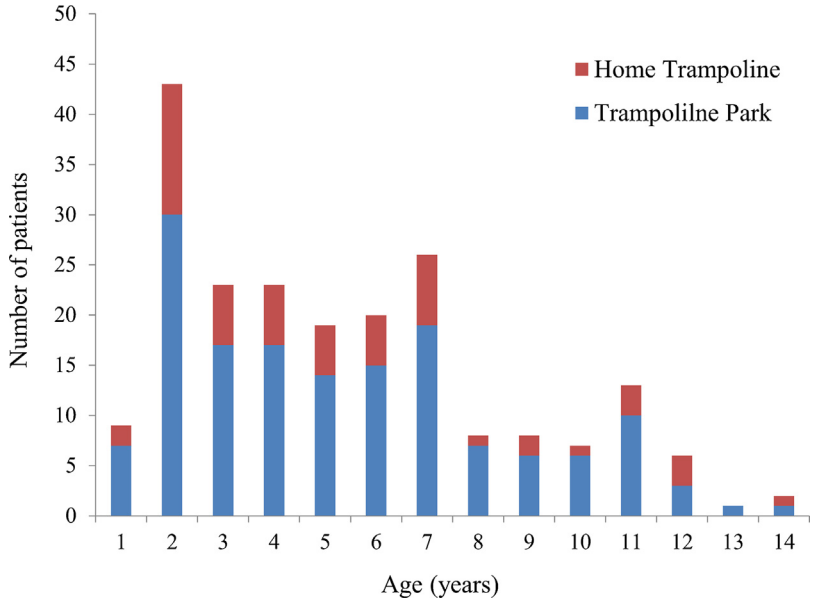

Fig. 1. Age distribution and sites of trampoline-related orthopedic injuries.

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