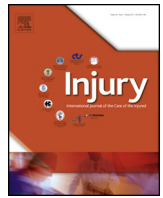




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Retrospective analysis of 616 air-rescue trauma cases related to the practice of extreme sports

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ABSTRACT

Introduction: Extreme sports (ESs) are increasingly popular, and accidents due to ESs sometimes require helicopter emergency medical services (HEMSs). Little is known about their epidemiology, severity, specific injuries and required rescue operations.

Aim: Our aims were to perform an epidemiological analysis, to identify specific injuries and to describe the characteristic of prehospital procedures in ES accidents requiring HEMSs.

Methods: This is a retrospective study, reviewing all rescue missions dedicated to ESs provided by HEMS REGA Lausanne, from 1 January 1998 to 31 December 2008. ES were classified into three categories of practice, according to the type of risk at the time of the fall.

Results: Among the 616 cases meeting inclusion criteria, 219 (36%) were clearly high-risk ES accidents; 69 (11%) and 328 (53%) were related to potential ES, but with respectively low or indeterminate risk at the time of the fall. In the high-risk ES group, the median age was 32 years and 80% were male. Mortality at 48 h was 11%, almost ten times higher than in the other two groups. The proportion of potentially life-threatening injuries (the National Advisory Committee for Aeronautics (NACA) score ≥ 4) was 39% in the high-risk ES group and 13% in the other two groups. Thirty per cent of the cases in the high-risk ES group presented an Injury Severity Score (ISS) >15 , compared with 7% in the other groups. Thoracolumbar vertebral fractures were the most common injuries with 32% of all cases having at least one, involving the T12–L2 junction in 56% of cases. The other most frequent injuries were traumatic brain injuries (16%), rib fractures (9%), pneumothorax (8%) and femoral (7%), cervical (7%), ankle (5%) and pelvic (5%) fractures. Median time on site for rescue teams was higher in the confirmed high-risk ES group, with 50% of prehospital missions including at least one environmental difficulty.

Conclusions: High-risk ESs led to high-energy accidents, characterized by a large proportion of severe injuries and axial traumas (spine, thorax, pelvis and proximal femur). We identified a considerable percentage of thoracolumbar vertebral fractures, mainly in the T12–L2 junction. HEMSs dedicated to high-risk ESs implied longer and more complex interventions.

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Introduction

Extreme sports (ESs) are becoming increasingly popular in Western countries, resulting in a growing number of non-professional practitioners and increasing diversification of such sports [1]. All of these activities increase the risk of injury, but little is known about their epidemiology and characteristics.

Interestingly, to date, no universal criteria have been proposed for the concept of 'extreme sports' [1]. Usually, it refers to the limits of ordinary practice, at the far end of something often remaining unclear: technical difficulty, dangerousness, high-intensity physical

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effort or spectacular activity. To avoid this problem of unclear definition, some legal and insurance regulations use an arbitrary, non-exhaustive list of sports considered as 'extreme'. For example, the 'Swiss ordinance for mountain guiding and other hazardous adventure' and the Swiss National Accident Insurance Fund (SUVA) list reckless activities to reduce their benefits, including autocross, speed flying, full contact, base-jumping or hydrospeed [2,3]. Obviously, there is no common ground between these activities and little overlap between the lists.

The ES concept conveys a second problem. There are many ways (extreme or not) to practise the same potentially 'extreme sport'. In other words, the popularity of ESs may trivialize the term 'extreme' [5].

Several kinds of ESs are practised, and a substantial part of the prehospital rescue operations is consequently devoted to accidents and injuries related to these activities. Previous publications generally focused on a specific sport, such as airborne sports [6–8], rock climbing [9,10], skiing and snowboarding [11–13] or mountain biking [14], regardless of their way of practising (extreme or not) or the mechanism of the lesion (acute accidental or chronic) [15,16]. Those who practise ESs are required to test their courage and their own boundaries [4]. Despite the absence of an unequivocal definition, ESs share common characteristics: outdoor activity, unusual and unsafe environment, little or no regulation and practice without any guide or coach. All of these features contrast with other sports and finally expose helicopter emergency medical service (HEMS) rescues to numerous difficulties and risks. A previous study on safety in alpine helicopter rescue operations showed that rescue personnel must have specific skills [17], but there are no data for ES accidents requiring HEMS prehospital rescue operations.

The aim of our study was to describe the epidemiology of ESs in Western Switzerland. The primary goal was to extract demographic parameters and to compare the dangers of ESs according to the risk of the practice at the time of the fall. The secondary goal was to search for specific types of injuries and to determine the features of prehospital rescue missions dedicated to ES accidents.

To the best of our knowledge, this is the first study performed in a European country, specifically analysing ESs and considering the kind of practice related to ESs.

Patients and methods

Setting

This study was conducted in the Canton of Vaud, located in the western part of Switzerland. This area consists of different geographic regions. Alpine valleys and mountains, rivers and lakes characterize Western Switzerland's geography with many popular locations for winter sports, mountaineering, rock climbing, airborne sports, mountain biking and water activities.

The HEMS is engaged by a dispatch centre using specific keyword-based dispatch protocols. A remote location or a difficult terrain can also be a reason for HEMS activation. The HEMS crew includes a pilot, a paramedic trained for helicopter hoist operation and an emergency physician.

ES and extreme practice 'a priori' definitions

In order to address the difficulties of definitions and banalization, we distinguish the kind of ES practice at the time of the accident according to the risk taken: extreme practice with a high risk of accident or common practice with an acceptable low risk. Our study focuses therefore on ES with a high risk of accident. From this point of view, 'extreme' refers to the danger of fall because of

great height, high speed, hardly controllable risk or hostile environmental variables (terrain, climate and natural obstacles).

Based on inclusion criteria, we separated the cases in three levels of practice and risk-taking categories. The first group consisted of confirmed high-risk ES accidents. Height (>2 m high), high speed or specific difficulty with environmental variables (terrain and climate) were explicitly identified in the medical report. The second group consisted of accidents involving ESs potentially but without any significant risk-taking at the time of the fall. In these cases, although the patients exercised an ES, the way of practice at the time of the fall was obviously low risk, because of a low or medium speed, a limited height or a conventional terrain without environmental difficulties. Meanwhile, the third group involved unknown conditions for the practice at the time of the accident, because of missing or inconclusive data in the medical report about the speed, height, terrain or mechanism of the fall.

ES cases were grouped in five categories according to similarities of practice and common mechanisms of fall: airborne sports (paragliding, speed flying, skydiving, hang-gliding and traction kite), cycling (mountain biking), water sports (wakeboarding and kite surfing), mountain sports (rock climbing and mountaineering) and winter sports (skiing, snowboarding, sledging and high-mountain snowshoeing).

Study design

This retrospective study analysed every rescue mission performed by the HEMSs of the Lausanne REGA base from 1 January 1998 to 31 December 2008. We searched a standardized pre-existing registry for all cases of accidents resulting from a fall, during the practice of a sport that could be considered extreme. We included all adult (>15 years) patients sustaining an injury while practising a sport, which could be considered extreme and imply a risk of fall.

Exclusion criteria were motorized or indoor sports, fall resulting from a medical cause (including suicide) or not directly related to the practice of ES and injuries from external causes (stone fall, motionless patient struck by another person).

Data collection

At the end of the HEMS intervention and 48 h after admission to the emergency department (ED), data were systematically collected, including descriptions of prehospital life-saving measures, procedures or interventions on site (medico-legal procedure, resuscitation with transport to the ED, on-site urgent care, analgesia, clinical examination, unsuccessful resuscitation and death pronouncement), as well as diagnosis and outcomes.

For each case, we extracted socio-demographic parameters (year, age, sex and type of sport) and details about the fall (speed, height, mechanism of the fall and environment). The types of injuries were described by anatomical location and severity. Prehospital life-threatening injuries were identified according to the National Advisory Committee for Aeronautics (NACA) score [18]. Potentially life-threatening injuries were defined by an NACA score ≥ 4 . ED final diagnosis severity was evaluated according to the Injury Severity Score (ISS) [19]. Severe injuries were defined by an ISS > 15. We extracted mortality at 48 h. Finally, we identified the features of rescue difficulties, including on-site difficulties, defined by access difficulties, use of a winch and/or need for a professional mountain guide. Duration of rescue operations on site was also recorded.

Statistical analysis

Descriptive statistics were generated, using means and standard deviation (SD) for normally distributed data, and medians

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