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Epidemiological and medical aspects of canyoning rescue operations

Inigo Soteras [a,b,*], Enric Subirats [a,b], Giacomo Strapazzon [c]

[a] Cerdanya Hospital, Camino de Ur 31, 17520 Puigcerdà, Spain
[b] Faculty of Medicine, Girona University, Emili Grahit 77, 17071 Girona, Spain
[c] EURAC Institute of Mountain Emergency Medicine, Viale Druso 1, 39100 Bolzano, Italy

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ABSTRACT

Aim: To describe the characteristics of canyoning rescue operations (CRO), type and severity of injuries or illnesses, and on-site medical procedures.
Patients and methods: A retrospective analysis of all CRO data from an emergency medical rescue team in Aragon, Spain, between 1 August 1999 and 31 July 2009.
Results: A total of 520 patients were identified, with a male to female ratio of 1.4. The median age was 32 years (range 10–73 years). The median time from the emergency call to admission to an acute care facility (or evacuation for uninjured patients) was 90 min (range 10–860 min). In 329 (63.3%) cases technical skills or ability in the terrain with some grade of difficulty was required. Accessibility of the incident site was associated with type of rescue ($p < 0.0001$), where patients in incident sites with moderate to extremely difficult access were more often rescued by ground rescue alone or supported by air rescue than by air rescue alone. 419 (80.6%) patients had trauma-related injuries. The most common injuries involved the lower extremities (74%). The percentage of patients with a NACA score ≥ 4 was higher for medical/environmental illnesses than traumatic injuries ($p < 0.0001$), despite that the total number was smaller. 175 (33.7%) patients received analgesics. 370 (71.2%) patients required splinting/immobilization. Major life-saving medical interventions were rarely performed on-site.
Conclusions: The length and exposure to environmental factors validates the importance of emergency physicians and paramedics in CRO. Physicians and paramedics should be familiar with Pre-hospital Trauma Life Support, medical procedures related to environmental, topographical and logistical conditions, and helicopter rescue operations including winch operations.

Introduction

Canyoning is the term used for a recreational activity involving travel through narrow canyons and water. Canyoning combines various outdoor skills including walking, scrambling, climbing, jumping, abseiling with a single rope, anchor building and/or swimming. The first descent of a canyon was reported in 1893 in Southern Europe, though canyoning increased in popularity only in the last decade in Europe and North America.[1–3] Canyoning can be challenging and risky and requires careful planning even on short trips. The hazards include water (e.g. flash floods, whitewater), accidental hypothermia, heat-related illnesses, cliffs, confined spaces and hazardous surfaces.[2,4] One web-based survey showed that traumatic injuries and environmental illnesses are common.[2]

Canyoning is one of the most common activities resulting in a request for search and rescue (SAR) in some regions.[1,5–7] The Autonomous Community of Aragon, located in the Pyrenees, Spain, is one of the most popular canyoning areas in Europe and has a high percentage of canyoning rescue operations (CRO) (up to 40% of all SAR operations per year in Sierra de Guara National Park, Spain).[5] Because of this high rate and the uniqueness of CRO, SAR services operating in popular canyoning areas had to develop specific training for physicians and paramedics.[4,6,8] The International Commission for Mountain Emergency Medicine (ICAR medcom) developed specific recommendations for canyoning rescue for physicians and professional guides.[9] Knowledge of the environment, technical skills and specific equipment is needed for SAR operations and on-site triage and medical treatment in CRO. Currently, data on incident characteristics and rescue procedures are scarcely reported in peer-reviewed literature and the ICAR MedCom recommendations are based on expert consensus.[9,10] The medical procedures outlined in the recommendations have never been compared to what is performed pre-hospitally in CRO. The

* Corresponding author at: Cerdanya Hospital, Camino de Ur 31, 17520 Puigcerdà, Spain. Tel.: +34 606995252.
E-mail address: inigosoteras@yahoo.es (I. Soteras).

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aim of this study was to describe the characteristics of CRO, type and severity of injuries or illnesses, and on-site medical procedures using data from a region with extensive experience in canyoning rescue. The study was approved by the local ethics committee.

Patients and methods

In this retrospective study, pre-hospital data were collected from all CRO conducted by an emergency medical rescue team (and involving a helicopter) in Aragon, Spain, from 1 August 1999 to 31 July 2009. Data included the time from the emergency call to admission to an acute care facility (or evacuation for uninjured patients), age and gender of the patient, type of injury/illness and location of the main injury (or main illness) as reported by the emergency physician. An emergency physician was present in all CRO. The severity of the injury or illness was graded using the 7-level scale of the National Advisory Committee for Aeronautics (NACA) by the emergency physician immediately after the rescue mission, based on the mechanism of injury and clinical parameters (Table 1).[11,12] Injuries or illnesses were classified as minor/moderate (NACA 1–3), severe (NACA 4–6) or lethal (NACA 7). The level of consciousness of the victim on-site was graded using the Glasgow Coma Scale. CRO were classified as air, ground or ground supported by air rescue (i.e. with helicopter support/evacuation). Accessibility of the incident site was classified as easy, moderate, difficult or extremely difficult in accordance to a comprehensive evaluation of terrain, water and abseiling. On-site medical procedures included oxygen administration, intravenous line access, fluid or drug administration, airway management (i.e. endotracheal tube or other supraglottic airway devices), cardiopulmonary resuscitation, reduction of dislocations, splinting/immobilization, hypothermia prevention and antibiotic prophylaxis in accordance to ICAR MedCom recommendations.[9] The helicopters were not equipped with a winch.

The distribution of the data was shown in a univariate descriptive analysis. Differences in characteristics between patients were calculated using chi-square tests for categorical variables and Bonferroni corrections for multiple comparisons. Descriptive statistics were expressed as mean and SD or median and range, as appropriate. SPSS version 20.0.0 statistical software (SPSS Inc., Chicago, IL) was used and $p < 0.05$ was considered statistically significant.

Results

499 canyoning rescue operations were conducted in the 10-year period. 298 of 520 (57.3%) patients were male with a male to female ratio of 1.4. Data were missing in 5 cases (1%). The median age was 32 years (range 10–73 years); there were 23 (4.6%) paediatric patients (≤15 years).

Table 1
7-level scale of the National Advisory Committee for Aeronautics (NACA).[12]

NACA 0	No injury or illness
NACA 1	Injuries/diseases without any need for acute physicians care
NACA 2	Injuries/diseases requiring examination and therapy by a physician, but hospital admission is not indicated
NACA 3	Injuries/diseases without acute threat to life but requiring hospital admission
NACA 4	Injuries/diseases that can possibly lead to deterioration of vital signs
NACA 5	Injuries/diseases with acute threat to life
NACA 6	Injuries/diseases transported after successful resuscitation of vital signs
NACA 7	Lethal injuries or diseases (with or without resuscitation attempts)

Characteristics and time of CRO

The distribution per year and month are shown in Figs. 1 and 2. The number of patients rescued in CRO had no trend across the years. Across the months there was an increase in the number of incidents during the summer months; 278 (53.4%) patients were rescued in July and August. Air rescue was used in 262 (50.4%) cases and to support ground rescue in 215 (41.3%) cases. CRO were performed only by ground personnel in 30 (5.8%) cases; in 13 (2.5%) cases the data were missing. 329 (63.3%) cases required technical skills or ability in terrain with some grade of difficulty. 11 (2.1%) cases were in incident sites classified as extremely difficult. Accessibility of the incident site was associated with type of rescue ($p < 0.0001$), where patients in incident sites with moderate to extremely difficult access were more often rescued by ground rescue alone or supported by air rescue than by air rescue alone. The median time from the emergency call to admission to an acute care facility (or evacuation for uninjured patients) was 90 min (range 10–860 min). The median rescue time with ground rescue alone (130 min, range 40–860 min) or supported by air rescue (120 min, range 30–720 min) was longer than with

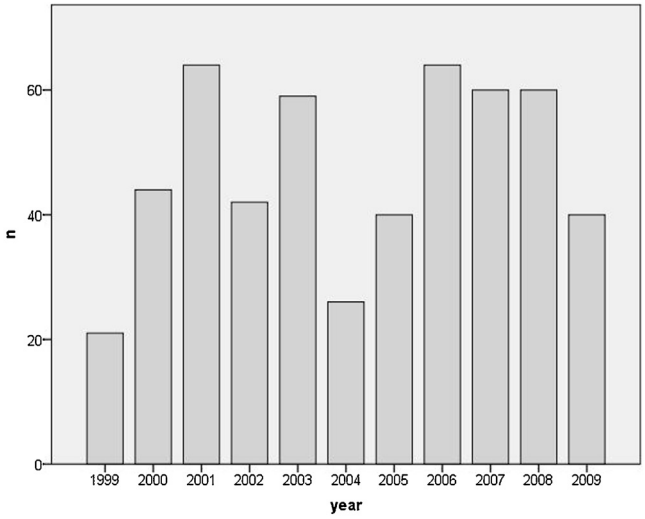

Fig. 1. Distribution per year of patients in canyoning rescue operations.

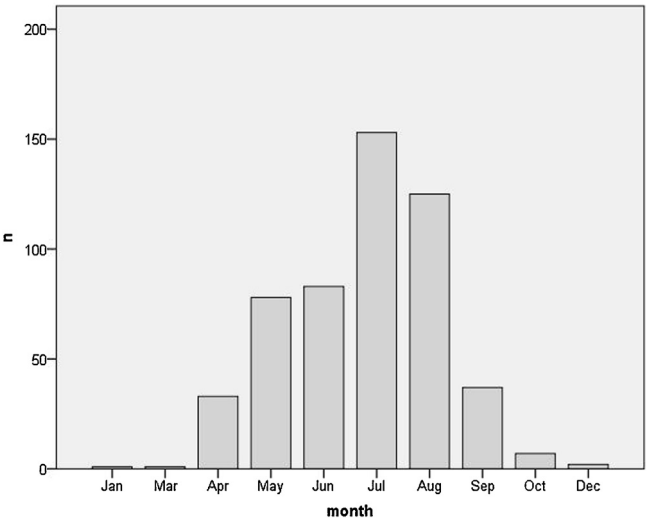

Fig. 2. Distribution per month of patients in canyoning rescue operations.