

## REVIEW ARTICLE

# International Commission for Mountain Emergency Medicine Consensus Guidelines for On-Site Management and Transport of Patients in Canyoning Incidents

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Canyoning is a recreational activity that has increased in popularity in the last decade in Europe and North America, resulting in up to 40% of the total search and rescue costs in some geographic locations. The International Commission for Mountain Emergency Medicine convened an expert panel to develop recommendations for on-site management and transport of patients in canyoning incidents. The goal of the current review is to provide guidance to healthcare providers and canyoning rescue professionals about best practices for rescue and medical treatment through the evaluation of the existing best evidence, focusing on the unique combination of remoteness, water exposure, limited on-site patient management options, and technically challenging terrain. Recommendations are graded on the basis of quality of supporting evidence according to the classification scheme of the American College of Chest Physicians.

*Keywords:* canyon, search and rescue, trauma, accidental hypothermia, heat-related illnesses, drowning

## Introduction

Canyoning (referred to as “canyoneering” in Australia, New Zealand, and the United States) is a recreational activity involving travel through a narrow valley or gorge with steep sides or cliffs. Canyoning requires the use of a variety of techniques and technical skills, including jumps, slides, and walking or scrambling on wet surfaces, rappelling down waterfalls, swimming through cold pools and swiftwater, and employing advanced rope work.<sup>1</sup> Development of specialized equipment and techniques has facilitated commercial operations and exploration of increasingly more difficult canyons. Park officials in the

United States and Australia, as well as canyoning associations in Europe, have reported increases in usage in the most popular areas over the past 2 decades.<sup>2,3</sup> The associated increase in rescues accounts for 15 to 40% search and rescue (SAR) missions/cost in specific geographic locations.<sup>3,4</sup> SAR operations in canyons are frequently necessary when companion rescue fails and often require special considerations because of remoteness, difficult terrain (Figure 1), and limited communication.<sup>1</sup> Specially trained and equipped SAR teams have been established, but there is no international consensus pertaining to minimum requirement levels of medical training and technical training for canyoning rescue. The International Commission for Mountain Emergency Medicine (ICAR MEDCOM) has published recommendations for canyoning rescue for professional guides and for equipment to be used by canyoning rescue doctors.<sup>5</sup> These recommendations, published in 2001,

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**Figure 1.** Transport of a stretcher by a canyoning SAR team. A, Floating transport in a water-filled passage during canyon SAR operation. B, High-angle terrain in a wet canyon. (Courtesy of Michael Kammerer. Available at: <http://www.kong.it/>.)

were based on consensus opinions of experts. The goal of the current review is to provide further updated guidance to healthcare providers and canyoning rescue professionals about best practices for rescue and medical treatment through the evaluation of the existing best evidence related to the potential canyoning incidents.

## Methods

The ICAR MEDCOM convened an expert panel to develop evidence-based recommendations for on-site management and transport of patients in canyoning incidents. Experts were selected on the basis of clinical or research experience with canyoning rescue. The panel agreed not to use a PICO (patient/problem, intervention, comparison, outcome) question strategy for the evaluation process, but generated a set of topics (Table 1) to define the most significant areas of interest. The authors performed an extensive literature search using electronic databases and manual searches. The Medline database was searched for articles using PubMed. No language restrictions were applied. We used the following search strategy: (canyoning [MeSH Terms] OR canyoning [All Fields] OR canyoneering [All Fields] OR barranquismo [All Fields] OR torrentismo [All Fields]). We included studies of canyoning activities that reported data on the epidemiology of canyoning, plus on-site management

and transport of patients in canyoning incidents. Peer reviewed articles and abstracts as well as medical theses were considered eligible for inclusion. The authors independently screened the titles of all articles and abstracts identified by the search. Following screening, authors manually reviewed the materials to determine which were suitable for inclusion. The authors also reviewed the reference lists of the articles retrieved by the electronic searches to find other relevant reports not indexed in the electronic databases. Subsequently, the selected panel of experts graded each recommendation on the basis of quality of supporting evidence according to American College of Chest Physicians classification scheme (Table 2).<sup>6</sup> Where necessary, peer reviewed, randomized controlled trials, observational studies, case series, and case reports related to on-site management of specific topics were further used to grade recommendations, or to support expert consensus. Conclusions of review articles and non-peer-reviewed articles or book chapters were only used to provide background information; they were not used for grading recommendations. For those topics of interest where no best evidence was evident, the panel made recommendations based on expert consensus. The recommendations were further examined and consensus was reached at a manuscript meeting in Borovets, Bulgaria, in October 2016.

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