

Fatality risk in rock climbing

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Abstract

With the current increase of popularity in all climbing disciplines a profound injury risk and fatality analysis is important. While many climbers participate in the various different disciplines of climbing sports, all of these have different risk profiles. This is mostly based on different environmental exposures, external harassments and objective danger. In the following article the various sub-disciplines indoor, sport climbing, bouldering, alpine (traditional) climbing as well as ice climbing and mountaineering will be analyzed concerning the fatality risk. The overall injury rate in climbing is low, with most injuries being of minor severity. Nevertheless the risk of a fatal injury is always present. The fatality rate varies from the different sub-disciplines performed and is the lowest for indoor climbing, bouldering or sport climbing. It is naturally higher for alpine climbing or free solo climbing. External factors as objective danger through e.g. wind chill or rock fall add to the risk.

Concept

Toutes les disciplines d'escalade jouissent d'une réelle popularité, mais il est important de bien connaître le risque d'accident et d'analyser les accidents pouvant être mortels. Beaucoup de grimpeurs se livrent à de nombreuses disciplines d'escalade qui peuvent avoir pour conséquence des lésions aussi nombreuses que variées. Ceci est dû principalement au caractère de l'environnement, à des fatigues externes et extrêmes et à un réel danger. L'article qui suit prendra en compte les sous-disciplines concernant l'escalade en salle, l'escalade sportive, le bloc et l'escalade classique, tout comme l'escalade de glace et l'alpinisme. Le risque de lésion, en escalade, est relativement bas et la plupart des lésions sont guérissables. N'oublions pas, cependant, que le risque d'un accident mortel est toujours présent. Il dépend, bien sûr, des sous-disciplines pratiquées et il restera minime en salle, en bloc et en escalade sportive. Il augmente en milieu alpin ou en escalade libre, quand on grimpe en solo. Certains facteurs extérieurs peuvent aussi représenter un danger supplémentaire: le vent (plus vif, plus froid) ou la chute de pierres ou de roches.

Introduction

Rock climbing is a multi-disciplined sport. Depending on the sub-discipline, the climber's experience and skills, grade of route's difficulty, equipment, climbing surface, remoteness of location, altitude and weather will implicate different levels of risk and difficulty (Schöffl, 2013; Schöffl, Morrison, Schöffl, & Küpper, 2012). In addition to these variables, many climbers regularly participate in more than one climbing sub-discipline, which need to be looked up separately (Schöffl et al., 2012; Schöffl, Morrison, Schwarz, Schöffl, & Küpper, 2010). In general, there are five major types of climbing (Schöffl et al., 2012; Schöffl, Morrison, Schwarz, et al., 2010): mountaineering, alpine (traditional) climbing, sportclimbing (including bouldering), Indoor climbing and vertical ice climbing (Schöffl et al., 2012; Schöffl, Morrison, Schwarz, et al., 2010). The borders in between these disciplines are fluctuant and many climbers regularly participate in more than one climbing sub-discipline (Schöffl et al., 2012; Schöffl, Morrison, Schwarz, et al., 2010). Various articles have looked upon the injury risk, but little data is available concerning the risk of fatalities (Schöffl, 2017). As even the "safest" form of climbing, indoor climbing has fatalities, these need to be further explored.

Methods

Our search procedures included an initial PubMed query using the key words "rock climbing", "sport climbing", "mountaineering", "alpine injuries" and "climbing injuries". More than 500 extracted papers were analyzed which gave information on injury, mortality, prevention and risk factors. Cross-references were also scanned

according to the above given criteria. In addition the data sources of the UIAA and IFSC Medical commissions were analyzed.

Results

Traditional, Indoor, sport climbing and bouldering

For indoor climbing few studies exist presenting prospective data on catastrophic injuries (Schöffl, Lutter, Wollings, & Schöffl, 2018). One study by Schöffl et al. (2013) found no fatality in a prospective evaluation of over 515,337 indoor climbing wall entries during five years. Also an analysis of the 2012 IFSC climbing World Cup (Schöffl, Burtscher, & Coscia, 2013) and the World Championships in 2005 (Schöffl & Küpper, 2006) did not show any fatality. In personal correspondence the IFSC Medical Commission reports that no fatality ever happened in a World Cup since the IFSC foundation in 2009. Nevertheless, fatalities do occur in indoor climbing itself and are reported about in the press and other media (Schöffl, 2017). Statistics of the German Alpine Club reported 7 climbing deaths during 2006 and 2007 (DAV, 2008). These statistics do unfortunately not differentiate between traditional, ice and sport climbing. For alpine climbing a fatality rate was documented by Bowie et al. (Bowie, Hunt, & Allen, 1988) – 13 of 220 injured climbers died - a case fatality rate of 6%. This case fatality rate was much smaller than older American records from 1951 to 1960 that recorded 41% (Ferris, 1963), 23 % for the Grand Tetons (Schussmann, Lutz, Shaw, & Bohn, 1990) in 1982, and 8 % for the Sierra Nevada (McLennan & Ungersma, 1982). Schussmann (Schussman, Lutz, Shaw, & Bohn, 1990) calculated, based on 25 fatalities in his study a fatality rate of 0.13/1000h or a case fatality rate of 23%. Bowie et al. (Bowie et al., 1988) Yosemite results are in accordance with the results of Hubicka (Hubicka, 1977) for European climbing areas. The analyses in these climbing injury studies were conducted retro-spectively using questionnaires, and therefore may be prone to recall bias. The “older” studies (20 years ago) (Addiss & Baker, 1989; Bowie et al., 1988; Schussmann et al., 1990) reported the most severe injuries and highest fatality rates, while recently a prospectively conducted study on bouldering (Josephsen et al., 2007) reported no fatalities at all (Schöffl et al., 2012).

Ice Climbing

The general death numbers in ice-climbing can be analysed through the injury and fatality reports of the various Alpine Clubs (Schöffl et al., 2012). The Canadian (Canadian-Alpine-Club, 2007) and the American Alpine Club (American-Alpine-Club, 2006) have statistically recorded and analysed all mountain accidents since 1951. In the USA, up to the year 2005, there were 6111 incidents with a total of 1373 (12%) fatalities (American-Alpine-Club, 2006). 254 (4%) of the accidents happened in ice, though no further evaluation of the ice-climbing injuries was given. Nevertheless if 4% of all injuries are to be accounted to ice-climbing, also 4% of the deaths can be assumed to be related to ice-climbing. This would calculate to 55 fatal ice-climbing injuries in 54 years; in average one ice-climbing fatality per year within the USA. The numbers for Canada are similar (Canadian-Alpine-Club, 2007). In 30 years, 92 mountaineers were injured while ice-climbing, 30 fatally. Overall the major ice climbing countries, Switzerland and Canada, report about one death per year (Mosimann, 2006) (Canadian-Alpine-Club, 2007), nevertheless these numbers were raising in recent winters (Schöffl, 2017; Schöffl et al., 2012; Schöffl, Schöffl, Schwarz, Hennig, & Küpper, 2009). This is probably due to the fact that ice climbing itself became much more popular (Schöffl, 2017).

Mountaineering

Monasterio (Monasterio, 2005) prospectively surveyed 46 rock climbers/mountaineers over four years to determine the type and frequency of accidents. He reported five deaths - one unrelated to climbing, two in avalanche, and two from climbing 'misadventure.' Küpper (Küpper, 2006) found significantly more fatal accidents in men than women ($p < 0.05$), which may be a consequence of a higher risk acceptance in men. McIntosh et al. (McIntosh, Campbell, Dow, & Grissom, 2008) reviewed mountaineering fatalities on Mount McKinley, Alaska (6194m). In the latest years the fatality rate declined and was 3.08/1000 summit attempts. They found this fatality rate 20 times higher than those given for trekkers hiking in Nepal (Shlim & Houston, 1989) and even higher than those for English and Welsh mountaineers (Avery, Harper, & Ackroyd, 1990). McIntosh et al. (McIntosh et al., 2008) adjusted denominators to allow comparison and reported a fatality rate of 100/1 million exposure days on Mount McKinley, or a fatality rate of 0.063/1000h. Malcom (Malcom, 2001) reported 1.87/1000 days mountaineering fatalities on Mount Cook in New Zealand, or 0.12 fatalities per 1000h of mountaineering. This figure seems extremely high and may be the product of estimated exposure days based on hut night stays, rather than actual climbing days (McIntosh et al., 2008).

Firth et al. (Firth et al., 2008) calculated a mortality rate of 1.3% when examining causes of mortality among those who climbed Mount Everest from 1921 to 2006 ($n=192$ died from 28,276). Pollard et al. (Pollard & Clarke, 1988) found that at extreme altitude, 70% to 80% of mountaineering deaths were related to environmental factors. Salisbury (Salisbury, 2004) and Salisbury & Hawley (Salisbury & Hawley, 2007) identified mortality rates between 0 and 0.126 deaths for every 100 mountaineers climbing above 6000m. In recent years the mortality in mountaineering has declined (Windsor, Firth, Grocott, Rodway, & Montgomery, 2009). On 8000m peaks, ascent success rates declined with summit height, but overall death rates, and death rates during descent from the summit, increased with summit height (Firth et al., 2008; Huey & Eguskitza, 2001). For higher altitude not only the accident and fatality rate are important but the prevalence of altitude illness, which is between 28% and 34 % above 4000m (Basnyat, Lemaster, & Litch, 1999). These illnesses can be a contributing factor to an injury, accident or death (Schöffl et al., 2012).

For further understanding the UIAA Medcom also published a fatality risk classification (Schöffl, Morrison, Hefti, Schwarz, & Küpper, 2010).

Conclusion

While fatalities are occurring in all climbing disciplines, they are most common in mountaineering, alpine and ice climbing. Nevertheless, as they can and are happening in all climbing disciplines they always need to be in the climbers awareness.

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