BODY POSITIONS OF BURIED AVALANCHE VICTIMS

Daniel K. Kornhall MD [1, 2], Spencer Logan[3]*, and Thomas Dolven MD[4]

[1]Nordland Hospital Lofoten, Lofoten Islands, Norway
[2]East Anglian Air Ambulance, Cambridge, UK
[3]Colorado Avalanche Information Center, Boulder, CO, USA
[4]Haukeland University Hospital, Bergen, Norway

ABSTRACT: The body position of a buried avalanche victim can complicate rescuer's initial medical management. The Colorado Avalanche Information Center maintains an archive of avalanche accidents and fatalities and records victim's body and head positions whenever possible. Accident investigators recorded body position for 253, and head position for 159, fully buried victims. Our sample indicates that rescuers found about 65% of victims with their heads in a downhill position, and about 45% of victims in a prone position. Of the 12 possible combinations of head and body positioning, about 40% of victims were found prone with their heads downhill, where both head and body position was recorded (n=135). These finding indicate that rescuers utilizing modern excavation techniques, digging laterally toward the victim from downhill, will access the victim's head and thorax before the rest of the body. Rescuers could begin airway management and ventilations before complete extrication of the victim. To provide chest compressions effectively, however, rescuers will have to turn victims onto their back. If this requires further extrication, it may preclude effective cardiopulmonary resuscitation. We believe current training in avalanche rescue should prepare rescuers for the eventuality of having to manage victims in nonsupine positions.

This research originally appeared in Wilderness & Environmental Medicine 27 (2016), pp. 321-325, Wilderness & Environmental Medicine 27 (2016), pp. 321-325. doi:10.1016/j.wem.2016.02.008

KEYWORDS: accidents, avalanche burial, avalanche rescue, prehospital care, wilderness medicine

1. INTRODUCTION

Avalanche rescue is a desperate race as rescuers attempt to locate and extricate the victims within their time window of survival (Haegeli et al 2011; Falk et al 1994). Medical management starts the moment the rescuers gain access to the victim's face and chest, and the victim's body position dictates initial efforts. Fully extracting victims may be time consuming, forcing rescuers to provide medical care under awkward conditions for extended periods. Medical personnel and rescuers are trained to assess and manage victims in a supine body position. Rescuers are trained to handle avalanche victims carefully out of concerns for causing hemodynamic instability or for aggravating spinal injury (Brugger et al 2013). Thus, locating and extricating avalanche victims in positions other than supine has the potential to complicate the immediate medical management.

To our knowledge, the current medical literature does not report on which body positions are common in buried avalanche victims. In order to address this, we performed a retrospective review of a large avalanche incident database that includes information on the body positioning of some buried avalanche victims.

2. METHODS

We reviewed the avalanche incident database of the Colorado Avalanche Information Center (CAIC). This database strives to track information for avalanche accidents in the United States, including the body and head positioning of buried victims.

We used a subset of the database containing only completely buried victims (victim was buried completely beneath the snow surface with no body part or attached equipment visible). We then further subset victims where head and body positioning was recorded. The database records classified head position as uphill or downhill in relation to the rest of the body, or as lying sideways with the head in the same level as the rest of the body. Body position was classified as prone, supine, the victim lying on his/her side, or as sitting/standing.

* *Corresponding author address:*
Spencer Logan, Colorado Avalanche Information Center, Boulder CO 80305; tel: 303-499-9650; email: spencer.logan@state.co.us

3. RESULTS

The database included entries for 1989 avalanche victims from events occurring between April 1951 and March 2014 in the US. After excluding non- or partially buried victims as well as entries that did not state the degree of burial, we identified 1085 victims who had experienced complete burial.

3.1 Head position

Records included head position for 159 buried victims (Tbl. 1). Rescuers found 65% (104) of those buried avalanche victims with their heads in a downhill position, 23% with their heads uphill and 11% with their heads in the same level as the rest of their bodies.

Records included travel mode at avalanche impact for 114 of these victims. Eighty-two percent (94) were on skis. Of buried skiers, 66% (62) were found with their heads in a downhill position, 24% had their heads uphill, and 10% were found with their heads across slope (Tbl. 1). Other travel mode groups were too small to produce meaningful comparisons.

Tbl. 1. Head positions of buried avalanche victims

Head position	*All*	*Skiers*
Downhill	104 (65%)	62 (66%)
Uphill	37 (23%)	23 (24%)
Across slope	18 (11%)	9 (10%)
Total	159	94

3.2 Body Position

Records included body position for 253 buried victims (Tbl. 2). Rescuers found 45% (113) of victims lying prone, 24% supine, 16% sitting or standing, and 15% lying on their sides.

Travel mode was documented for 173 of these victims, of which 83% (n = 143) were skiers (Tbl. 2). Of buried skiers, 42% were found prone, 26% supine, and 17% on their side.

Tbl. 2. Body positions of buried avalanche victims

Body position	*All*	*Skiers*
Prone	113 (45%)	60 (42%)
Supine	61 (24%)	37 (26%)
Sitting/standing	41 (16%)	22 (15%)
On side	38 (15%)	24 (17%)
Total	253	143

3.3 Head and Body Positon

We identified 135 victims where both head and body position was registered. Forty percent of victims were found prone with their heads in a downhill position (Tbl. 3).

Tbl. 3. Combined head and body positions of avalanche victims

		Head Position		
		Downhill	Uphill	Across slope
Body Position	Prone	54 (40%)	8 (6%)	4 (3%)
	Supine	18 (13%)	12 (9%)	5 (4%)
	On side	11 (8%)	5 (4%)	8 (6%)
	Sitting/ standing	5 (4%)	4 (3%)	1 (1%)

4. IMPLICATIONS

Our limited data suggest that rescuers will find the majority of victims (65%) with their heads in a downhill position. Almost half of victims (45%) will be found prone. Of the 12 possible combinations of head and body positioning, victims found prone with their heads downhill stood out as the dominant combination, accounting for 40% of victims.

We believe the victim's position will have significant impacts on the immediate medical management. Avalanche medical rescue training should emphasize managing victims in non-supine positions.

Our findings may highlight a benefit of strategic shoveling techniques (Edgerly 2010; Genswein 2008). If the majority of victims are positioned with their heads downhill, rescuers digging laterally toward the victim from downhill will, in the majority of cases, access the victim's head and torso before the rest of the body. Rescuers can initiate airway management and ventilation before extracting the victim further.

Our study comes with limitations and requires careful interpretation. Our review is retrospective. Although the database strives to be comprehensive, there are considerable amounts of missing data, and our sample of victims with recorded body positioning was small. Our data is from a period of more than 60 years. During that time, equipment, types of activity, awareness, forecasting and rescue strategies, among other factors, have changed dramatically.

ACKNOWLEDGEMENTS

Many thanks to everyone who reports and documents avalanche accidents and incidents. The CAIC database relies entirely on information gathered by avalanche professionals from around the US.

REFERENCES

Brugger H, Durrer B, Elsensohn F, et al. Resuscitation of avalanche victims: evidence-based guidelines of the international commission for mountain emergency medicine (ICAR MEDCOM): intended for physicians and other advanced life support personnel. Resuscitation. 2013;84:539–546.

Edgerly B. The ABCs (and D) of digging: avalanche shoveling distilled to the basics. The Avalanche Review. 2010;29:11.

Falk M, Brugger H, Adler-Kastner L. Avalanche survival chances. Nature. 1994;368:21.

Genswein M. Eide R. The V-shaped snow conveyor belt. Proceedings of the International Snow Science Workshop. September 21–25, 2008; Whistler, BC, Canada. Bozeman, MT: Montana State University Library; 2008.

Haegeli P, Falk M, Brugger H, Etter HJ, Boyd J. Comparison of avalanche survival patterns in Canada and Switzerland. CMAJ. 2011;183:789–795.