Rescue at Very High Altitude

ICAR MedCom Meeting - Toblach - October 2023

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Parks Canada Parcs Canada

International Commission for Alpine Rescue

CMH HELI-SKIING

ACMG
Association of Canadian Mountain Guides
Association canadienne des guides de montagne

Avalanche Canada

CANADIAN SOCIETY OF MOUNTAIN MEDICINE

UNIVERSITY OF CALGARY
CUMMING SCHOOL OF MEDICINE

Mount Logan

5959m

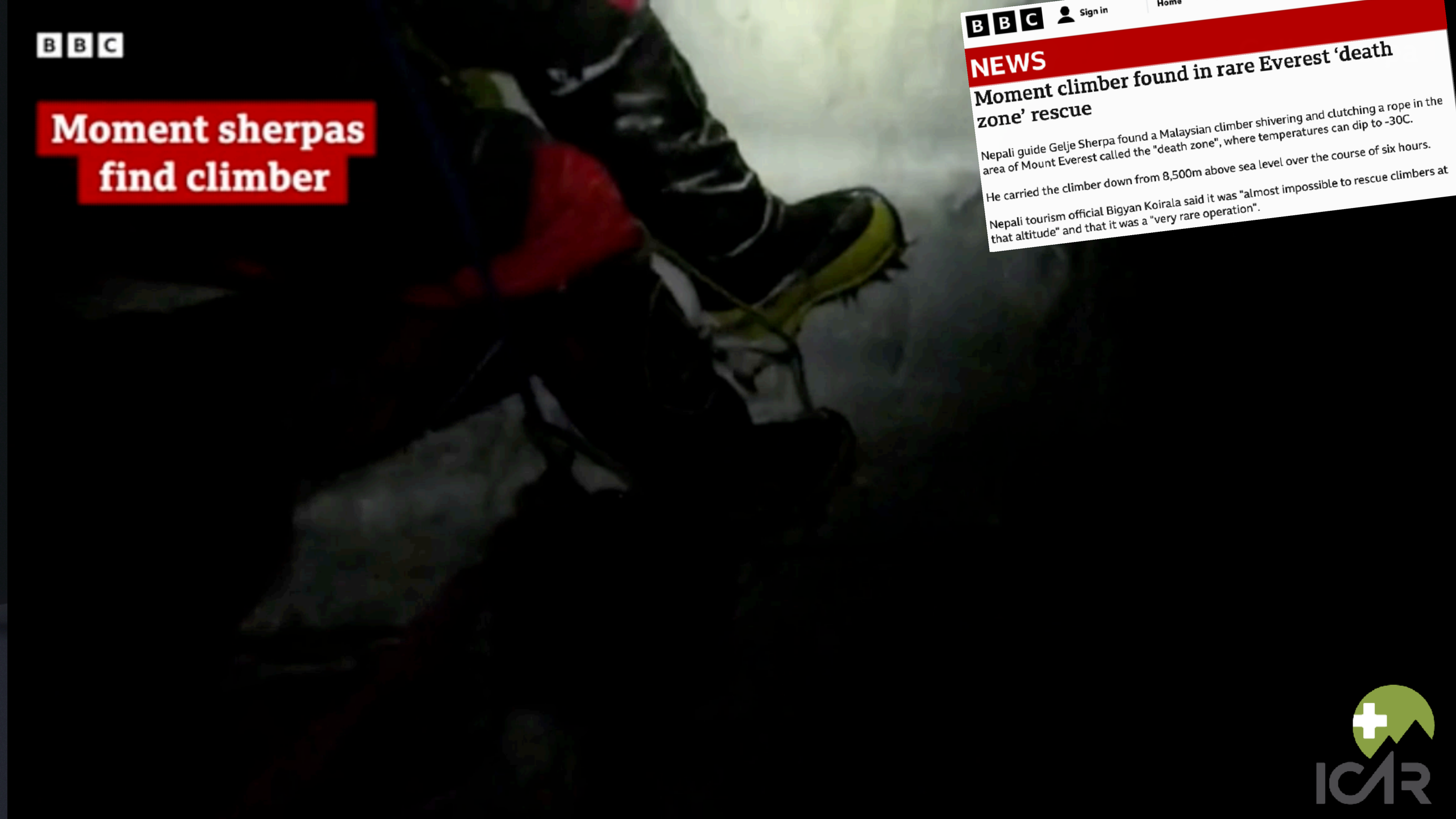
WILDERNESS MEDICAL SOCIETY CLINICAL PRACTICE GUIDELINES

Wilderness Medical Society Clinical Practice Guidelines for the Prevention, Diagnosis, and Treatment of Acute Altitude Illness: 2024 Update

Andrew M. Luks, MD[1]; Beth A. Beidleman, ScD[2]; Luanne Freer, MD[3]; Colin K. Grissom, MD[4]; Linda E. Keyes, MD[5]; Scott E. McIntosh, MD, MPH[6]; George W. Rodway, PhD, APRN[7]; Robert B. Schoene, MD[8]; Ken Zafren, MD[9,10]; Peter H. Hackett, MD[11]

	Risk Category		
Variable	**Low**	**Moderate**	**High**
History of acute altitude illness	None or mild AMS ☐	Moderate-Severe AMS ☐	HAPE or HACE ☐
Sleeping elevation on Day 1 (meters)	< 2800 ☐	2800-3500 ☐	> 3500 ☐
Ascent rate (meters/day)	≤ 500 m/d above 3000 m with extra days for acclimatization every 1000 m ☐	≥ 500 m/d above 3000 m with extra days for acclimatization every 1000 m ☐	≥ 500 m/d above 3000 m without extra days for acclimatization every 1000 m ☐

- Unacclimatized individuals are at risk of High Altitude Illness >2500m
- Prophylaxis with acetazolamide “strongly considered” for high risk ascent profiles.
- The appropriate dose of acetazolamide for elevations above 5000m has not been studied.
- High dose dexamethasone (4 mg every 6 hrs) “may be considered in very high risk situations, such as military or search and rescue personnel being airlifted to altitudes >3500 m with immediate requirement of physical activity, but should be limited to these circumstances”



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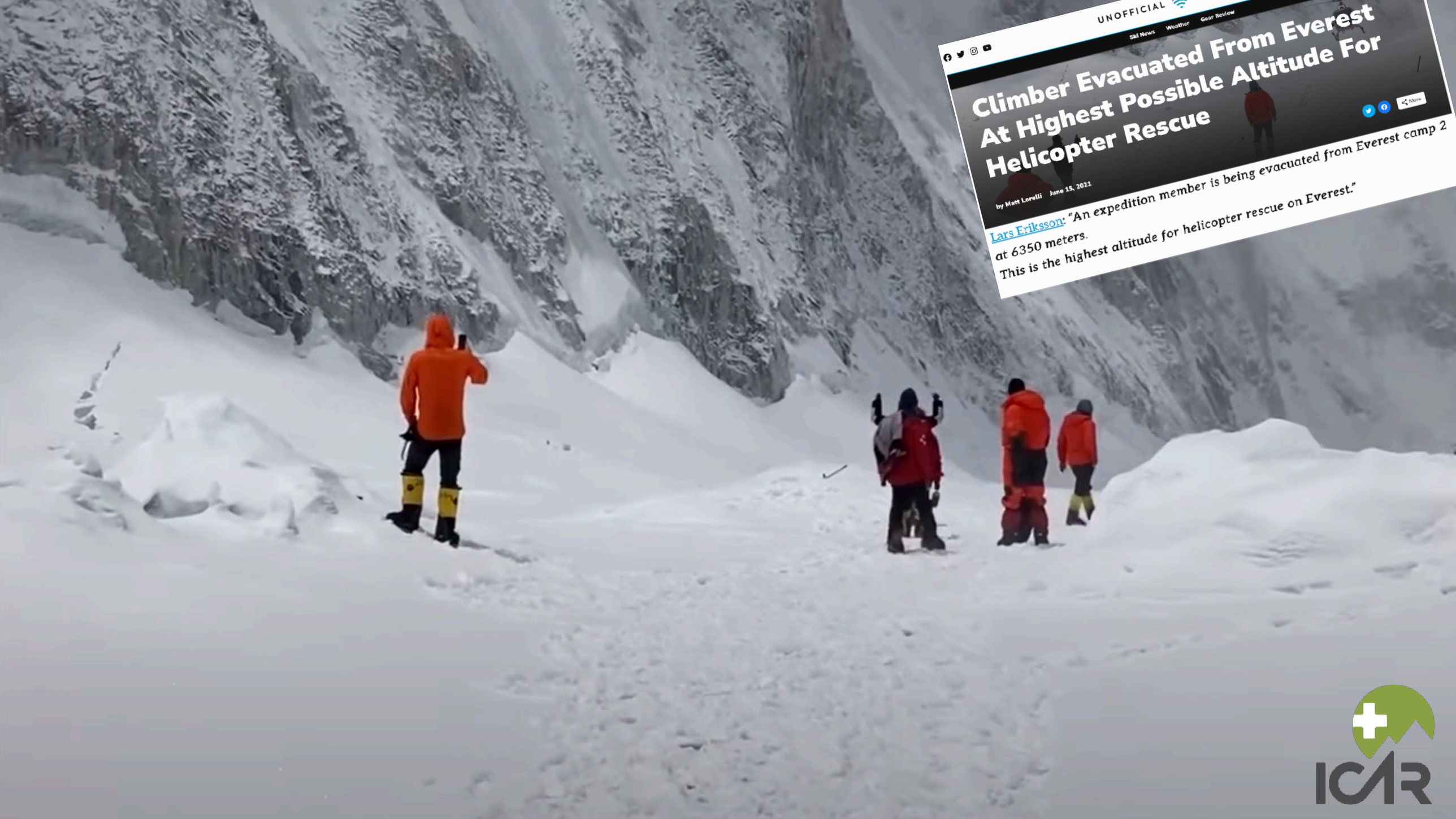
NEWS

Moment climber found in rare Everest 'death zone' rescue

Nepali guide Gelje Sherpa found a Malaysian climber shivering and clutching a rope in the area of Mount Everest called the "death zone", where temperatures can dip to -30C.

He carried the climber down from 8,500m above sea level over the course of six hours.

Nepali tourism official Bigyan Koirala said it was "almost impossible to rescue climbers at that altitude" and that it was a "very rare operation".


UNOFFICIAL
Ski News
Weather
Gear Review
Climber Evacuated From Everest At Highest Possible Altitude For Helicopter Rescue
by Matt Lorelli June 15, 2021
Lars Eriksson: "An expedition member is being evacuated from Everest camp 2 at 6350 meters.
This is the highest altitude for helicopter rescue on Everest."

Background

1.Rescues above 3500m are more complex and demanding

2.There are physical, physiological, psychological and meteorological challenges that may complicate rescue

3.Lack of recommendations

4.Variability in skill of rescuers

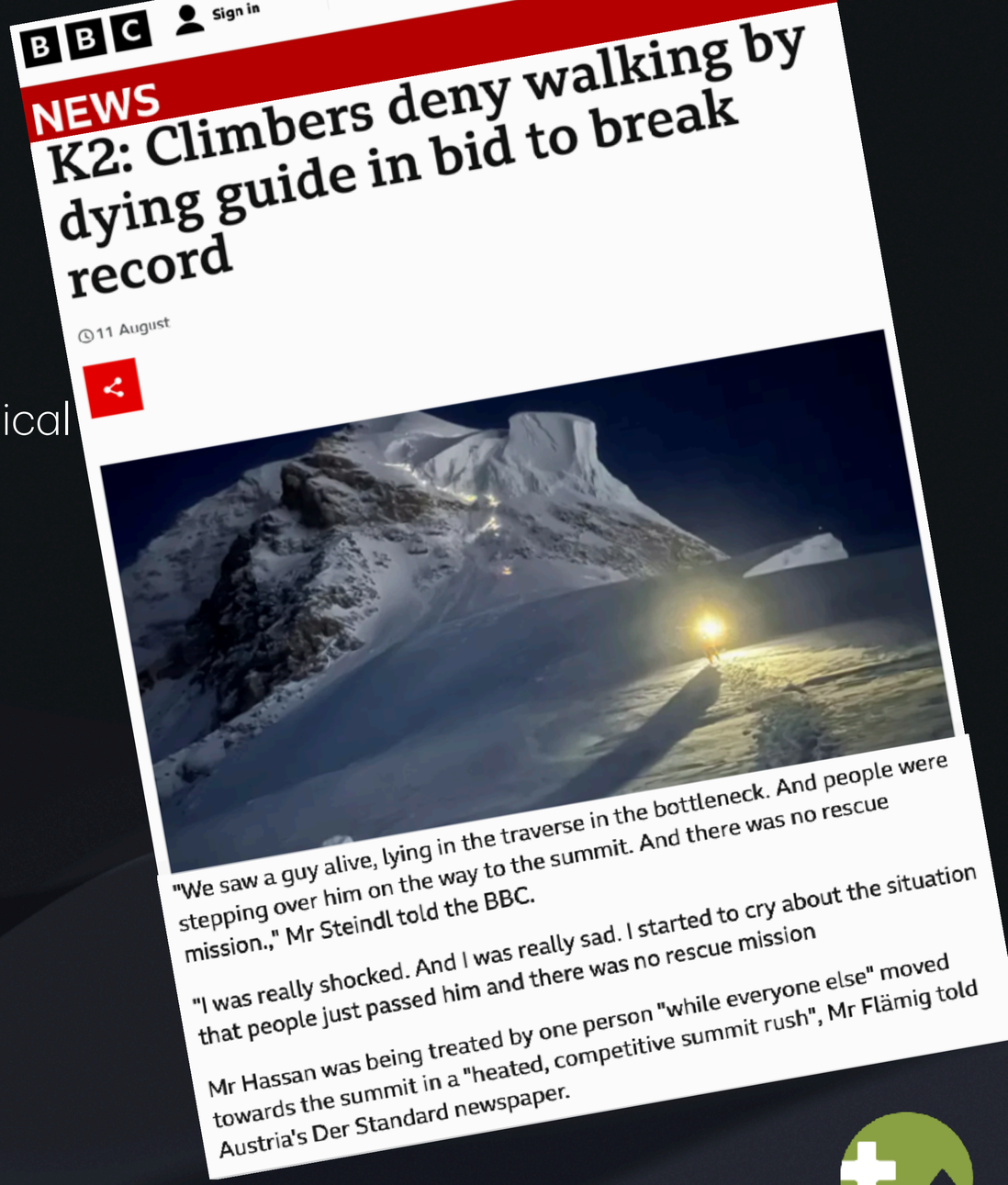
5.Variability in resources of rescue teams

6.Reports of inconsistent rescue response

7.Increased visitors to high altitude

8.Increased expectation of rescue at high altitude

9.Technology is advancing perhaps increasing our ability to rescue



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NEWS

K2: Climbers deny walking by dying guide in bid to break record

11 August

"We saw a guy alive, lying in the traverse in the bottleneck. And people were stepping over him on the way to the summit. And there was no rescue mission.," Mr Steindl told the BBC.

"I was really shocked. And I was really sad. I started to cry about the situation that people just passed him and there was no rescue mission

Mr Hassan was being treated by one person "while everyone else" moved towards the summit in a "heated, competitive summit rush", Mr Flämig told Austria's Der Standard newspaper.

THANKS TO OUR AUTHORS

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MED COM

AIR COM

TER COM

MOUNTAINEERS

PILOTS

GUIDES

10 Countries

Project Timeline

ICAR MedCom Montreux, Switzerland (OCT 2022)

Brainstorming topics for discussion Development (Nov- Dec 2022)

Research Protocol Established (Jan 2023)

Paper Divided into Sections (Jan 2023)

Sectional Leads, Authors & Questions Generated (Feb-Apr 2023)

Writing the Sections (May-Aug 2023)

Rough Draft (Sept 2023)

INTRODUCTION

Brugger, Paal, Zafren, Lechner, Agazzi

Discussion Points:

1. Categories of high altitude:
    - Very high altitude = 3500 to 5500 m
    - Extreme altitude = above 5500 m
2. Brief History of Rescues at Very High Altitude
3. Epidemiology
4. Varied Landscape in High Altitude Search and Rescue

INTRODUCTION

Brugger, Paal, Zafren, Lechner, Agazzi

Table 2. Annual death rates in high altitude climbing (modified from (14)

Mountain	Annual death rate per 1000 people at risk (%)	Time period
Aconcagua, 6961 m, Argentina (10)	0.8	2001-2012
Annapurna I, 8091 m, Nepal (11)	45.0	1970-2010
Cho Oyu, Himalaya (11)	6.4	1970-2010
Kilimanjaro, 5895 m, Tanzania (8, 9, 15)	0.3	2017
Mount Everest, Himalaya (11)	15.6	1970-2010
Denali, 6190 m, USA (16)	3.0	Not available?

Table 3. Main causes of death and associated risk factors in high altitude climbing (modified from (14))

Causes of Death	Risk factors
Acute altitude illness	Exposure
Avalanche burial	Inappropriate equipment
Hypothermia	Insufficient physical fitness
Trauma-related death (falls, rock/ice fall)	Lack of skill
	Pre-existing medical problems
	Exhaustion and Dehydration?

Table 1. Selection of historical rescue operations at very high and extreme altitude since 1970

Year	Country	Mountain	Altitude of rescue	Rescue operation	Reference
??	Nepal	Dhaulagiri (8167 m)	7000 m	Helicopter rescue of a Spanish climber by an Italian pilot using a long line. The climber died after the evacuation. The rescue operation lasted four days.	
1973	Nepal	Mount Everest (8848 m)	8790 m	Ground rescue from Hillary Step of two Italian climbers and a sherpa by an expedition member who carried bottled oxygen to their location.	
1985	Pakistan	Gasherbrum I (8080 m)	7500 m	Ground and helicopter rescue of a paralyzed Italian climber who was transported to camp 1 and evacuated by helicopter.	
1986	Pakistan	K2 (8611 m)	5300 m.	Ground rescue after fall into a crevasse of an Italian climber during attempt to climb the Magic Line on K2. He died after evacuation.	
1991	Nepal	Mount Everest (8848 m)	8350 m	Ground rescue of an Italian climber on the Everest North Face, who was struck by cerebral edema, after 5 days below the rock barrier in the Great Couloir.	
1996	Nepal	Mount Everest (8848 m)	7906 m	Ground rescue operation by a Kazakhstani climber, who rescued three stranded climbers during the "Mountain Madness" expedition.	
2005	Pakistan	Nanga Parbat (8125 m)	6000 m	A Slovenian climber was stranded in a snow cave on the South face (Rupal face) and was rescued after 6 days by helicopter.	

DRAFT

PATHOPHYSIOLOGY OF VERY HIGH ALTITUDE ON RESCUERS

Brugger, Paal, Zafren, Lechner, Luks

Discussion Points:

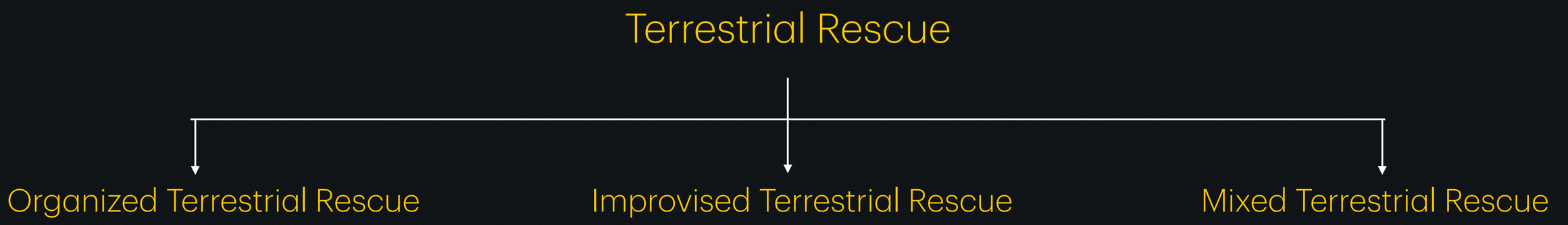
1. Hypobaric Hypoxia environment
2. Physiologic response
3. Clinical syndromes of Altitude Illness
4. Acclimatization
5. Specific effects on rescuers

TERRESTRIAL RESCUE

McLaughlin, Zafren, Piris, Jackson, Price, Tomazin, Barbish, Luks, Neudorfer, Donato

TERRESTRIAL RESCUE

McLaughlin, Zafren, Piris, Jackson, Price, Tomazin, Barbish, Luks, Neudorfer, Donato



Discussion Points:

1. Differences (ICS, skills, resources, acclimatization, communication, medical resources, financial/insurance, experience at altitude/ mountaineering)

2. Strategies for Mixed Terrestrial Rescue teams

3. Supplemental oxygen

4. Prophylactic medications for altitude illness

TERRESTRIAL RESCUE

McLaughlin, Zafren, Piris, Jackson, Price, Tomazin, Barbish, Luks, Neudorfer, Donato

Preliminary Recommendations

1. Recognize the differences between Improvised, Organized and Mixed Rescue Team - including their strengths and limitations.

2. Rescuer safety checklist

	Rescuer Safety Consideration	Strategy
1	High altitude mountaineering experience	☐ Identify rescuers with mountaineering experience at high altitude and physical condition
2	High altitude rescue experience	☐ Identify rescuers with past rescue experience at high altitude including technical rescue on snow, ice & crevasse ☐ Identify rescuers with experience with HEMS and long line rescue.
3	Meteorological concerns	☐ Review weather forecast and accommodate for a temperature drop of 1-2 degree C per 300m altitude gain and wind chill chart for long line rescue. (reference ?)
4	Helicopter considerations	☐ Identify pilots with experience at high altitude ☐ Adjust helicopter cabin weight, fuel volume & crew for the mission, ☐ Prepare for HEMS operation if indicated
5	Rest and recovery	☐ Determine safe location for patient drop off (Helicopter section will add information here) ☐ Rescue at very high altitude can be more physically strenuous and contingencies must be made to allow adequate rest and recovery for rescue team members. (Reference ?)
6	Altitude illness susceptibility of rescuers	☐ Identify rescuers with past history of altitude related illness including AMS, HACE, HAPE and avoid their deployment if possible
7	Oxygen therapy	☐ Indications for rescuers: (references) ☐ Indications for pilot: (references) ☐ Ensure adequate tanks for expected duration of rescue mission ☐ Consider using oxygen from higher altitude staches on the mountain if applicable
9	Medical Prophylaxis of Rescuers	☐ Indications for rescuers: (references) ☐ Indications for pilot: (references)

TERRESTRIAL RESCUE

McLaughlin, Zafren, Piris, Jackson, Price, Tomazin, Barbish, Luks, Neudorfer, Donato

Un-answered Questions:

1. Supplemental Oxygen for terrestrial rescuers on rapid ascent?

2. Prophylactic medications for terrestrial rescuers on rapid ascent?

HELICOPTER-ASSISTED RESCUE AT VERY HIGH ALTITUDE

Shimanski, Biner, Folini, Jackson, Strapazzon, Luks, Falla

Video: Maurizio Folini
Location: Everest
Camp 3 @ 7300 m

HELICOPTER- ASSISTED RESCUE AT VERY HIGH ALTITUDE

Shimanski, Biner, Folini, Jackson, Strapazzon, Luks, Falla

Discussion Points:

1. Operational considerations (Aircraft performance, adverse weather conditions, contingency planning)

2. Human external cargo (HEC) & rescuers exiting helicopter considerations

3. Training and Psychological considerations

4. Supplemental oxygen

5. Prophylactic medications for Altitude Illness

HELICOPTER- ASSISTED RESCUE AT VERY HIGH ALTITUDE

Shimanski, Biner, Folini, Jackson, Strapazzon, Luks, Falla

Preliminary Recommendations:

1. Operational Considerations:
    1. Reduce exposure time,
    2. Pre-flight assessment and checklist,
    3. Minimize helicopter and occupant weight
    4. Have a “Plan B” ground plan with survival kit
    5. Required to have specific training at altitude & proximity flying
2. Human External Cargo (HEC) tactic considerations

3. Provide psychological training and support

HELICOPTER- ASSISTED RESCUE AT VERY HIGH ALTITUDE

Shimanski, Biner, Folini, Jackson, Strapazzon, Luks, Falla

Preliminary Recommendations (cont'd):

4. Supplemental O2 is required for all aircraft occupants when flying 3000-4000m for greater then 30 min (Canadian and EASA Aviation Regulations) [3800-4300m for USA] regardless of acclimatization

5. Supplemental O2 is required for all aircraft occupants when flying above 4000m for any duration (Canadian and EASA Aviation Regulations) [>4300m for USA] regardless of acclimatization

6. Acclimatized pilots are preferred

HELICOPTER- ASSISTED RESCUE AT VERY HIGH ALTITUDE

Shimanski, Biner, Folini, Jackson, Strapazzon, Luks, Falla

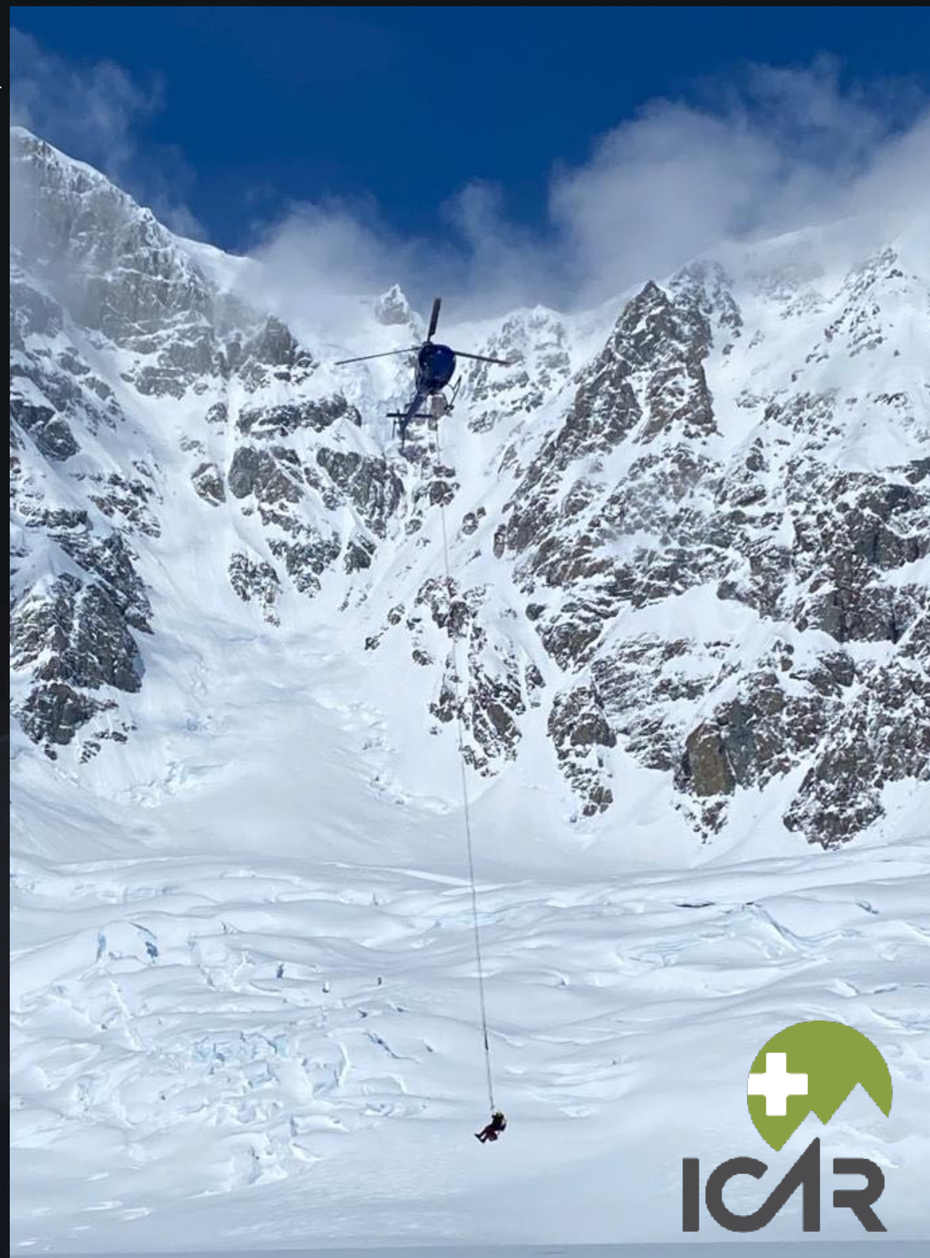
Un-answered Questions:

1. Should prophylactic medications be given to unacclimatized pilots and rescuers in helicopter assisted rescue during rapid ascent?

2. Should there be a limit on duration at altitude after rapid ascent? If so what is that?

3. Should there be a limit on duration outside of the helicopter for rescuers? If so, what would that be?

4. Should rescuers and pilots have treatment dose Altitude meds in their survival kit in case of machine failure or being stranded at altitude?



MEDICAL CARE AT VERY HIGH ALTITUDE

Smith, Roy,
Zafren, Brugger,
Holthof, Lechner,

MEDICAL CARE AT VERY HIGH ALTITUDE

Smith, Roy, Zafren, Brugger, Holthof, Lechner,

Discussion Points:

1. Barometric and non- barometric effects of high altitude on medical equipment and medications

2. Medical care, equipment and skills unique to the very high altitude environment

3.What are the expected medical conditions at very high altitude

MEDICAL CARE AT VERY HIGH ALTITUDE

Smith, Roy, Zafren, Brugger, Holthof, Lechner,

Preliminary Recommendations:

1. Effects of high altitude environment on medical equipment

Table 1. Effects of high altitude environment on medical equipment

Treatment or Equipment	Complication at Very High Altitude	Mitigation Strategies
MEDICAL EQUIPMENT		
Barometric Effects of High Altitude	Complication at Very High Altitude	Mitigation Strategies
Balloon-sealed tubes (Endotracheal tubes, certain supraglottic airways - King Tube)	An increase in ambient air pressure with descent may cause decrease in pressure in tube causing air leak or potentially displacement of tube	Use a manometer to measure pressure during flight, consider a non air-filled alternative like Igel suprglottic airway or instil saline instead of air
Portable Ventilators	Some portable ventilators will not function well at high altitude. Turbine-based ventilators in particular are often impacted by changes in gas density which will result in different delivered volume at different altitudes.	Ensure ventilators are calibrated for high-altitude prior to utilization on missions. Piston-based ventilators and bag-valve masks do not generally require compensation or calibration at altitude.
Non-Barometric Effects of High Altitude (e.g. Low Temperature, High Winds, High UV radiation, Condensation)	Complication at Very High Altitude	Mitigation Strategies
Hypothermia wraps	High wind conditions may make application of flimsy hypothermia wrap blankets impossible and/or they commonly will rip.	Follow standard "Burrito" wrap procedure (reference to WMS burrito wrap) and use a more robust hypothermia blanket wrap.
Metal laryngoscope blades	Metal laryngoscopes have been found to adhere to moist tongues in cold environments	Consider an alternative like a plastic laryngoscope blade
Plastic medical equipment (ie. endotracheal tubes, NG tubes, BVMs, masks etc)	Plastic tubing may freeze at cold temperatures causing reduced flexibility and mobility or fracturing.	Keep all plastic medical equipment warm in your jacket prior to application. Certain Bag-Valve-Masks (BVM) will function better at cold temperatures.
Reactant-based or protein-based testing	UV light and freezing can damage point-of-care testing, altering results	Equipment and reactants should be stored in opaque containers, protected from freezing and solar heating. When pre-test probability is moderate or high, clinical judgment should take precedence over negative results of tests known to be sensitive to envri[illegible]al conditions.
Battery power medical devices	Cold temperatures will deplete battery duration and/or may cause complete malfunction	Bring extra batteries or use a heat pad nea[illegible]es during their operation
Intravenous Fluids	May freeze, administration may cause worsening hypothermia	Only use if accompanied with a warmer [illegible] IV tubing.

MEDICAL CARE AT VERY HIGH ALTITUDE

Smith, Roy, Zafren, Brugger, Holthof, Lechner

Preliminary Recommendations:

2. Effects of high altitude environment on medications

Table 2. Effects of high altitude environment on medications

Treatment or Equipment	Complication at Very High Altitude	Mitigation Strategies
MEDICATIONS		
Barometric Effects of High Altitude	Complication at Very High Altitude	Mitigation Strategies
Volatile API or Excipient Loss	At lower pressure, APIs and excipients become more volatile. This may result in API or excipient loss (e.g. Nitroglycerin tablets may lose potency)	Consider packing liquid formulations which are metered at the time they are given or individually foil sealed oral or trancutaneous formulations.
Metered Dose Inhalers (MDIs)	At lower pressure, the total number of doses in an MDI may be somewhat decreased. A higher proportion of drug may be lost to evaporation at high altitudes.	Consider replacing MDIs early in medical stores even if they are not depleted. To counteract this drug loss, it is recommended to utilize a spacer when using MDIs at altitude.
Dry Powder Inhalers (DPIs)	DPIs such as the Turbuhaler or Accuhaler depend on the creation of turbulent flow for the deagglomerating process to occur. In a lower pressure environment, higher flow is needed to avoid laminar flow and induce turbulence. Conversely, due to the lower resistance of less dense air, patients experience increased flow for a given inhalation effort at lower altitude and may consequently decrease their inspiratory effort.	Consider using MDIs rather than DPIs when possible. When DPIs are the only option, instruct patients to increase inhalation effort. Store in a dry place.
Changes in Pharmacokinetics and Pharmacodynamics	Drug absorption and metabolism can change at altitude for a variety of physiologic reasons. This could potentially result in increased drug toxicity, drug accumulation, or conversely, less therapeutic effect. Example: high altitude hypobaric hypoxia is known to strengthen and extend nitroglycerin-induced peripheral vasodilation in healthy subjects. Vasodilating drugs may have an amplified effect and result in more profound therapeutic effects than intended without dose adjustment.	Providers should be familiar with the potential for abnormal pharmacokinetics and pharmacodynamics at high altitude, particularly in patients who are hypothermic or cold stressed, those with tachypnea or known metabolic derangements, and patients with GI upset and/or poor food intake due to altitude illness. Drug effects should be kept in the differential diagnosis when patients with symptoms of altitude illnesses do not improve with descent and treatment.
Non-Barometric Effects of High Altitude (e.g. Low Temperature, High Winds, High UV radiation, Condensation)	Complication at Very High Altitude	Mitigation Strategies
Medication or container damage	UV light, humidity, freezing or solar heating may all cause damage to medications or medication storage (e.g. vials or ampules).	Select medications known to be less affected by freezing. Choose flexible plastics rather than glass when possible. Favor tablet formulations over liquids or capsules. Medications that are both very sensitive to freezing and moderate heat in particulary (e.g. insulin) should be stored in a way that minimizes the risk of freezing or prolonged heating.
Oral and inhaled medications may clump	Oral and inhaled powders may clump or dissolve when moisture precipitates with large changes in altitude or local humidity. This may damage medications or render them impossible to effectively dose or administer.	Store medications in a dry containers that will not collect moisture. Consider packing with silica packs to reduce condensation.
Intravenous fluids	IV tubing is at high risk of freezing in subzero temperatures, particularly in the setting of high winds or rotor wash.	If intravenous lines are required, consider IV warmers designed for operational environments and protect lines from freezing by keeping them inside hypothermia wraps, etc.
Changes in Pharmacokinetics and Pharmacodynamics	Drug absorption and metabolism can change dramatically in patients with environmental exposures (e.g. hypothermia). This could potentially result in increased drug toxicity, drug accumulation, or conversely, less therapeutic effect. In particular, providers should be careful about using peripheral subcutaneous or intramuscular routes in patients who are cold stressed or hypothermic as peripheral vasoconstriction may dramatically slow absorption.	Select medications with flexible options for adminstration routes. Choose route d patient factors (e.g. level of consci hypothermia) as well as environm considerations (e.g. freezing of lin temperatures, rotor wash, etc).

MEDICAL CARE AT VERY HIGH ALTITUDE

Smith, Roy, Zafren, Brugger, Holthof, Lechner,

Preliminary Recommendations:

3. Patient care considerations at very high altitude checklist

	Patient Care Considerations	Strategy
1	Medical care of the patient at high altitude	Medical knowledge, skill and equipment to identify and treat: A. Altitude illness (AMS, HACE, HAPE) (Reference ?)
		B. Cold related illness (eg. Hypothermia and frostbite)
		C. Trauma
		D. Common illnesses (eg infectious disease, dehydration, electrolyte disturbance).
2	Medical Equipment for patients at High Alttude	☐ Oxygen for treatment of patient with altitude illness, respiratory illness, exhaustion, cardiac illness or trauma
		☐ Hypothermia wrap with chemical warming blanket, warm tea for hypothermia
		☐ Dressings for frostbite
		☐ Airway equipment including Igel supraglottic, BVM, NPA
		☐ Altitude illness medical treatment (Dexamethasone, Acetazolamide, Nifedipine)
		☐ Consider Gamow bag if prolonged duration at altitude expected
		☐ Dressings, splints, slings, tourniquets for trauma
		☐ AED for cardiac instability
		☐ Other medications: analgesics, antiemetics, electrolyte tablets, glucose tablets, antibiotics

MEDICAL CARE AT VERY HIGH ALTITUDE

Smith, Roy, Zafren, Brugger, Holthof, Lechner,

Un-Answered Questions:

1. Further review of the effects of hypobaric, hypoxic, cold temperatures, high UV and low humidity environment on medical equipment & medications.

2. Further work on the actual medical knowledge and skills required to manage common medical conditions at very high altitude

PHILOSOPHICAL & ETHICAL CONSIDERATIONS

Paal, Ellerton, Tomazin

Discussion Points:

1. What are the important ethical decisions and philosophical considerations that may affect rescuer safety and patient outcome in rescue at very high altitude?

PHILOSOPHICAL & ETHICAL CONSIDERATIONS

Paal, Ellerton, Tomazin

Recommendations:

1. When ethical aspects of a rescue mission are discussed, the four principles of Biomedical Ethics should be considered:

    1. Autonomy

    2. Beneficence

    3. Non-maleficence

    4. Justice

DISCUSSION & CONCLUSION

McLaughlin, Brugger

1. Operational Checklist for Rescuer Safety

	Rescuer Safety Consideration	Strategy
1	High altitude mountaineering experience	☐ Identify rescuers with mountaineering experience at high altitude and physical condition
2	High altitude rescue experience	☐ Identify rescuers with past rescue experience at high altitude including technical rescue on snow, ice & crevasse ☐ Identify rescuers with experience with HEMS and long line rescue.
3	Meteorological concerns	☐ Review weather forecast and accommodate for a temperature drop of 1-2 degree C per 300m altitude gain and wind chill chart for long line rescue. (reference ?)
4	Helicopter considerations	☐ Identify pilots with experience at high altitude
		☐ Adjust helicopter cabin weight, fuel volume & crew for the mission,
		☐ Prepare for HEMS operation if indicated ☐ Determine safe location for patient drop off (Helicopter section will add information here)
5	Rest and recovery	☐ Rescue at very high altitude can be more physically strenuous and contingencies must be made to allow adequate rest and recovery for rescue team members. (Reference ?)
6	Altitude illness susceptibility of rescuers	☐ Identify rescuers with past history of altitude related illness including AMS, HACE, HAPE and avoid their deployment if possible
7	Oxygen therapy	☐ Indications for rescuers: (references) ☐ Indications for pilot: (references)
		☐ Ensure adequate tanks for expected duration of rescue mission
9	Medical Prophylaxis of Rescuers	☐ Consider using oxygen from higher altitude staches on the mountain if applicable ☐ Indications for rescuers: (references)
		☐ Indications for pilot: (references)

DISCUSSION & CONCLUSION

McLaughlin, Brugger

2. Operational Checklist for Patient Care

	Patient Care Considerations	Strategy
1	Medical care of the patient at high altitude	Medical knowledge, skill and equipment to identify and treat: A. Altitude illness (AMS, HACE, HAPE) (Reference ?)
		B. Cold related illness (eg. Hypothermia and frostbite)
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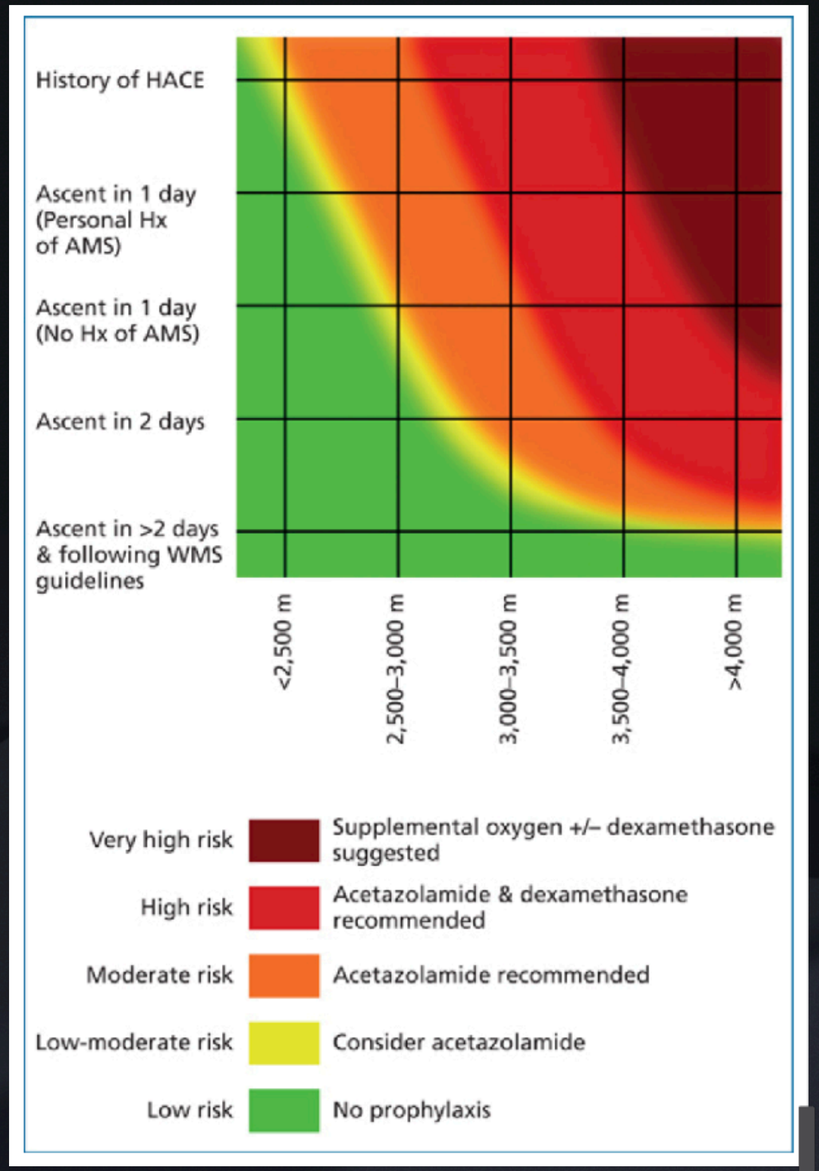
		☐ Consider Gamow bag if prolonged duration at altitude expected
		☐ Dressings, splints, slings, tourniquets for trauma
		☐ AED for cardiac instability
		☐ Other medications: analgesics, antiemetics, electrolyte tablets, glucose tablets, antibiotics

DISCUSSION & CONCLUSION

McLaughlin, Brugger

3. Rescue at High Altitude Prophylaxis Tool



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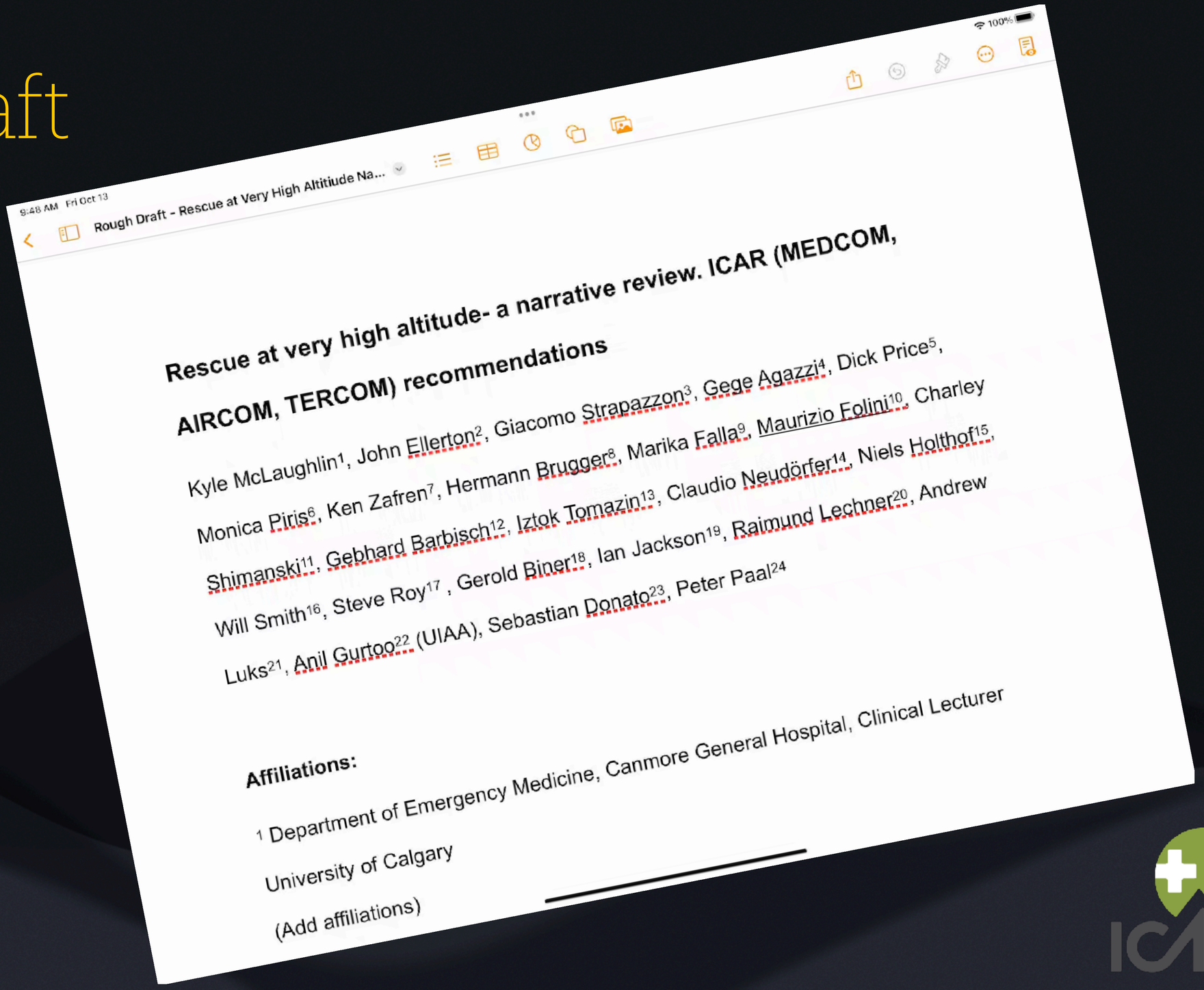

Next Steps

Dividing the Paper

Rescuer Safety at Very High Altitude

Medical Care at Very High Altitude

Dividing the Paper

Rescuer Safety at Very High Altitude

- Oxygen & Prophylactic Medications for Rapid Ascent
- Helicopter Rescue at High Altitude

Medical Care at Very High Altitude

OXYGEN & PROPHYLACTIC MEDS AT VERY HIGH ALTITUDE

ICAR MedCom

Questions:

1. O2 for rapid ascent?

2. Prophylactic meds (Acetazolamide, Dexamethasone, Nifedipine, Tadalaphil) for rapid ascent?

3.Terrestrial Rescue

4. Helicopter Rescue

Research Protocol:

- Scoping Review

Authors:

- McLaughlin, Roy, Paal, Zafren, Strapazzon, Falla and Musi

Target Journal:

- High Altitude Medicine & Biology

HELICOPTER RESCUE AT VERY HIGH ALTITUDE

ICAR Air Com + Med Com

Questions:

1. Operational considerations (Aircraft performance, adverse weather conditions, contingency planning)

2. Human external cargo (HEC) & rescuers exiting helicopter considerations

3. Training and Psychological considerations

4. Supplemental oxygen

5. Prophylactic medications for Altitude Illness

Authors:

- Shimanski, Biner, Maurizio, Jackson, McLaughlin

Target Journal:

- AirMed and Rescue

MEDICAL CARE AT VERY HIGH ALTITUDE

ICAR MedCom

Questions:

1. Barometric, Hypoxic, low temperature, low humidity and high UV effects of high altitude on medical equipment and medications

2. Medical care, equipment modifications required to safely manage patients at very high altitude with commonly expected conditions

3. Medical skills and technique unique to the very high altitude environment

Authors:

- Smith, Roy, McLaughlin, Holthof, Lechner

Target Journal:

- Wilderness and Environmental Medicine Journal

Dividing the Paper… further?

Rescuer Safety at High Altitude

- Oxygen & Prophylactic Medications for Rapid Ascent
- Helicopter Rescue at High Altitude

Medical Care at High Altitude

History of Helicopter Rescue at High Altitude

ICAR "Position Paper" for Rescue at High Altitude

Publication Possibilities

1. ICAR Recommendations

2. HAMB, WEMJ & AirMed & Rescue

3. Special issue OR ongoing rescue series with HAMB

4. Manual or Book

Other Discussion Points

Affiliations?

- ***UIAA***
- ***ISMM***

Kluane
National Park
and Reserve

Parc national et réserve
de parc national
Kluane

Parks Canada Parcs Canada

Canada

Thank you

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