

On-site treatment of avalanche victims

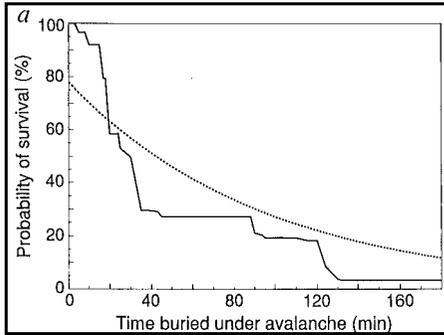
2022 recommendations of the International Commission for
Mountain Emergency Medicine (ICAR MedCom)

John ELLERTON / Mathieu PASQUIER / Alexandre KOTTMANN

WHY NOW?



1994



1996

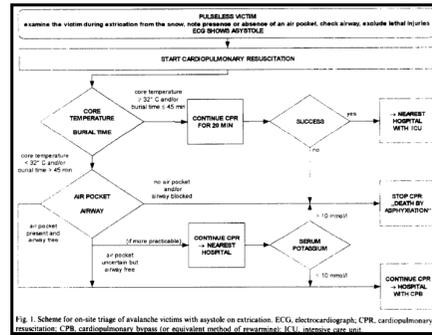
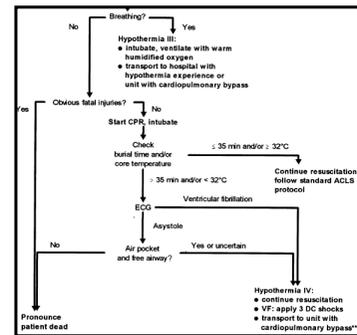
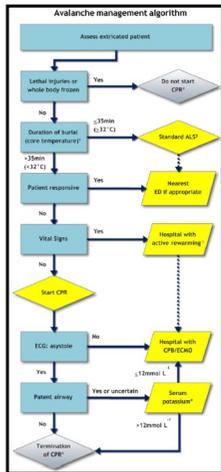


Fig. 1. Scheme for on-site triage of avalanche victims with asystole at extrication. ECG, electrocardiograph; CPR, cardiopulmonary resuscitation; CPB, cardiopulmonary bypass (or equivalent method of resuscitation); ECL, extracorporeal life support.

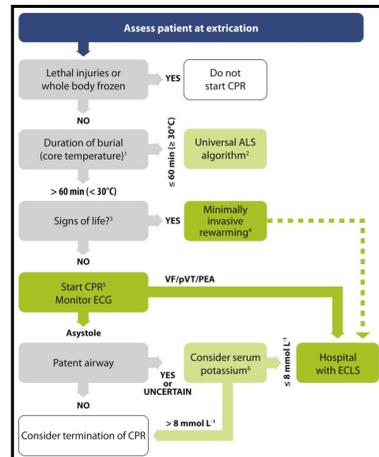
2001



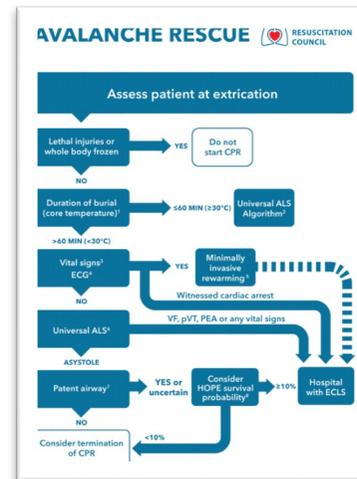
2013



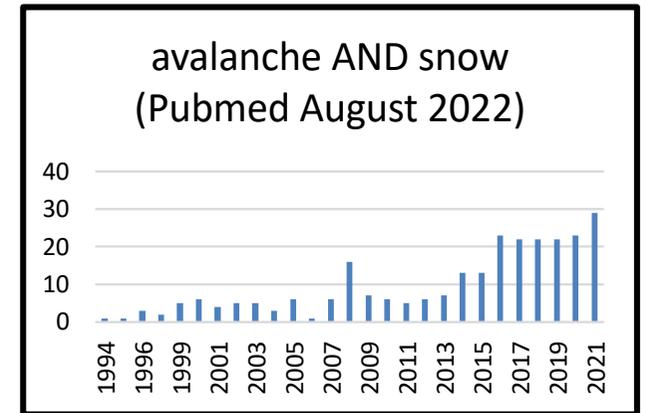
2015



2021



avalanche AND snow
(Pubmed August 2022)



HOW?



Writing Group + ICAR MedCom

Artoni Claudio, Blancher Marc, **Brugger Hermann** (senior), Ellerton John, Gordon Les, Kazu Ooshiro, Kottmann Alex, Matthias Jacob, McLaughlin Kyle, Martin Ron, Musi Martin, Paal Peter, **Pasquier Mathieu** (lead), Sheets Alison, Strapazzon Giacomo, Van Tilburg Christopher, Zafren Ken.

- | | |
|--------------------------|------------------------|
| • PICO questions | October 2021 |
| • Scoping review* | Nov => April 2022 |
| • Evidence summary | May => June 2022 |
| • Recommendations | July => September 2022 |
| • Algorithm | October 2022 |
| • Checklist | |

NOT TREATED:

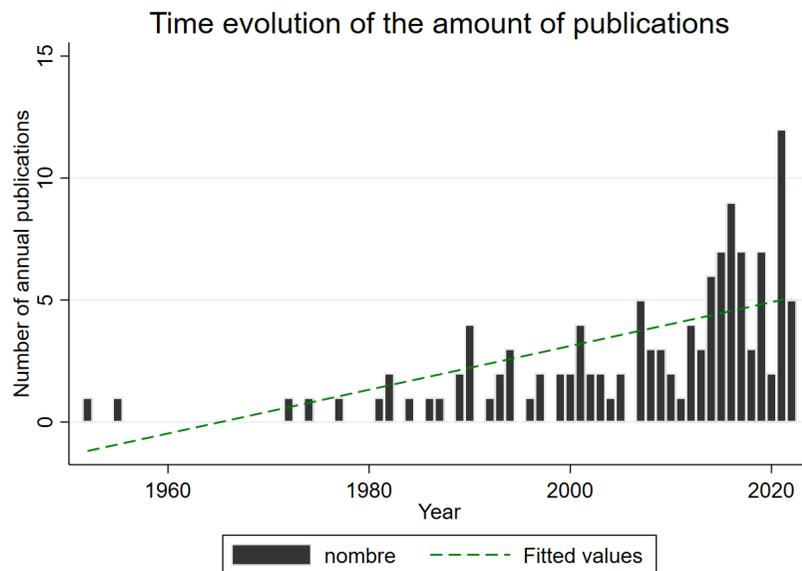
- **Prevention**
- **Extrication**
- **Multi-victims**

*Protocol available from <https://osf.io/x7u2n/>

RESULTS: SCOPING REVIEW



- **1959** references
- **120 studies** composed of original data



COUNTRY	n	%
Austria	23	19
Italy	22	18
Switzerland	20	17
USA	16	13
France	9	7.5
Norway	8	6.7

RESULTS: SCOPING REVIEW

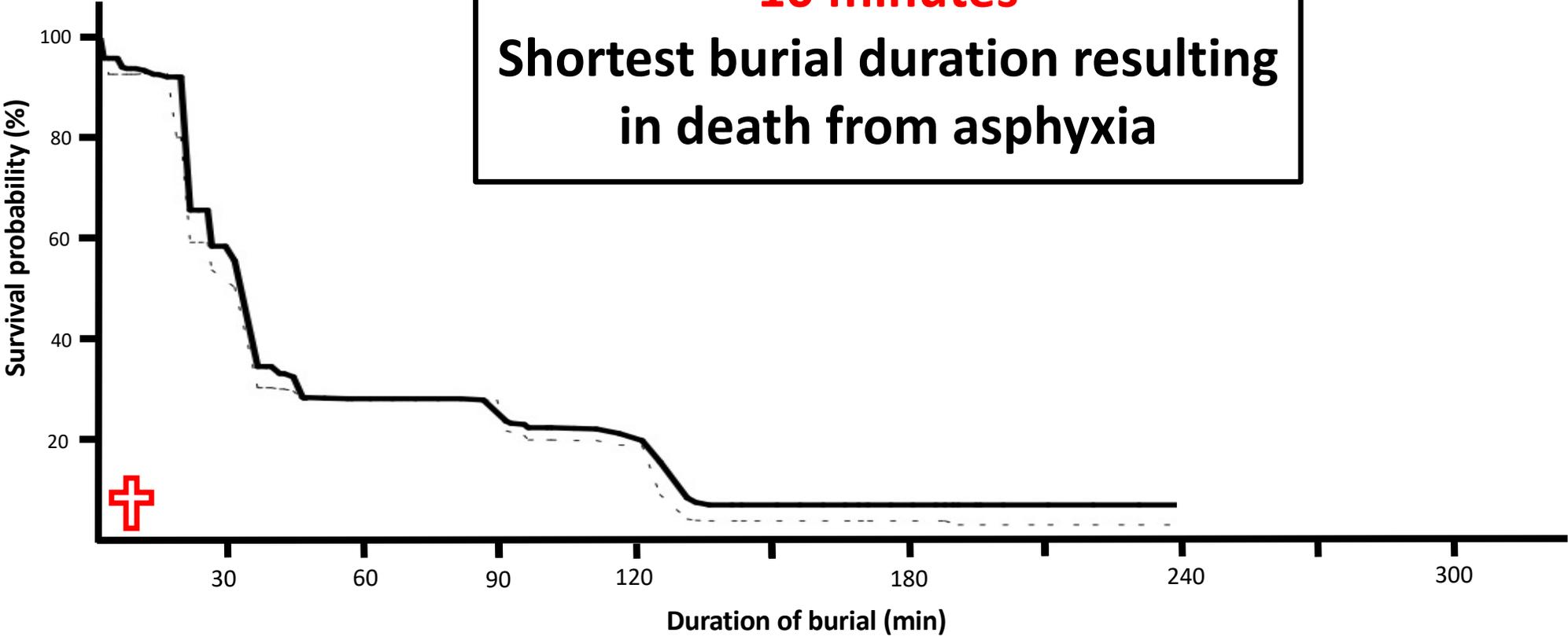


- **1959 references**
- **120 studies** composed of original data
 - 45 retrospective (38%)
 - 44 case reports or case series (37%)
 - 18 prospective on volunteers (including 7 RCT) (15%)
 - 8 descriptions of mass casualty incidents (6.7%)
 - 3 observational studies (surveys) on avalanche victims (2.5%)
 - 2 prospective animal studies (1.7%).

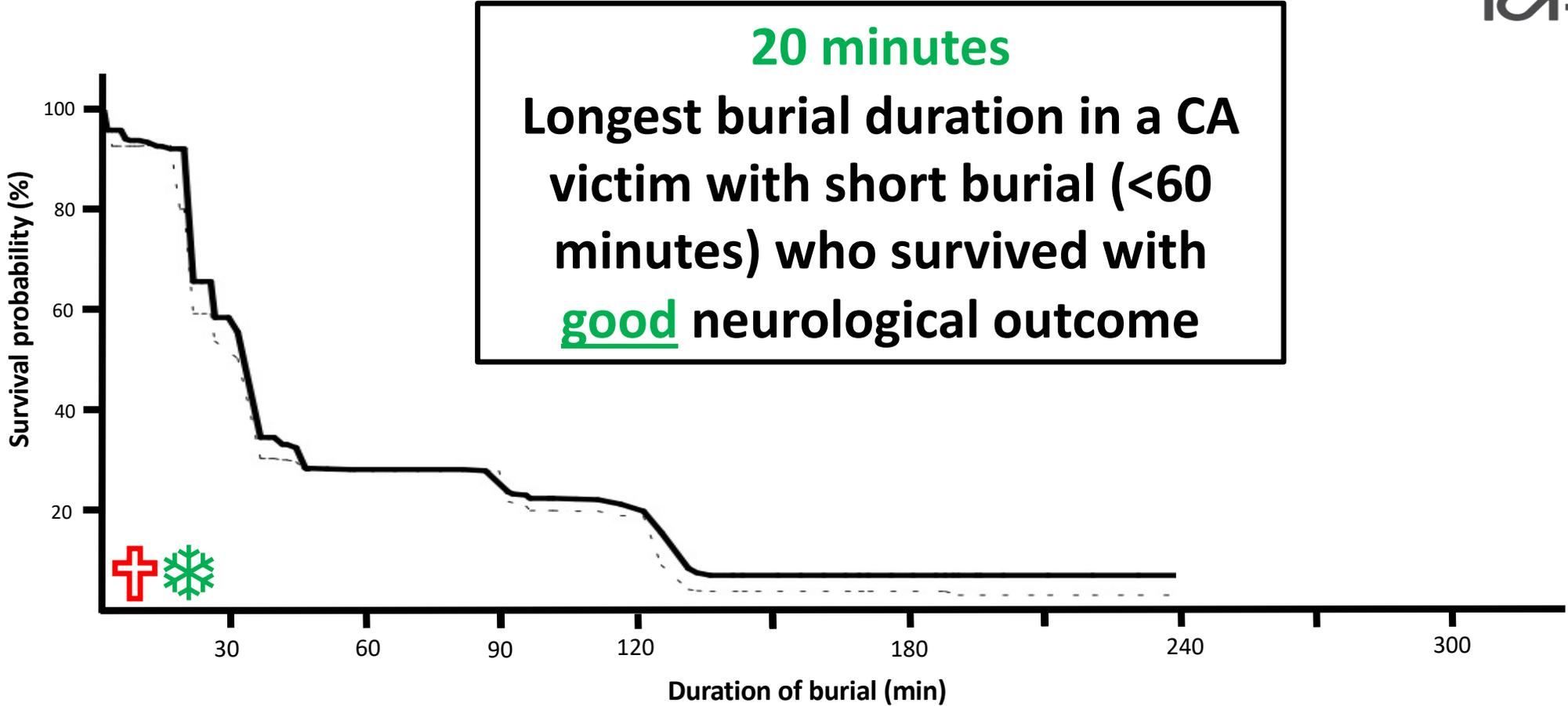
RESULTS: EXTREME CASES



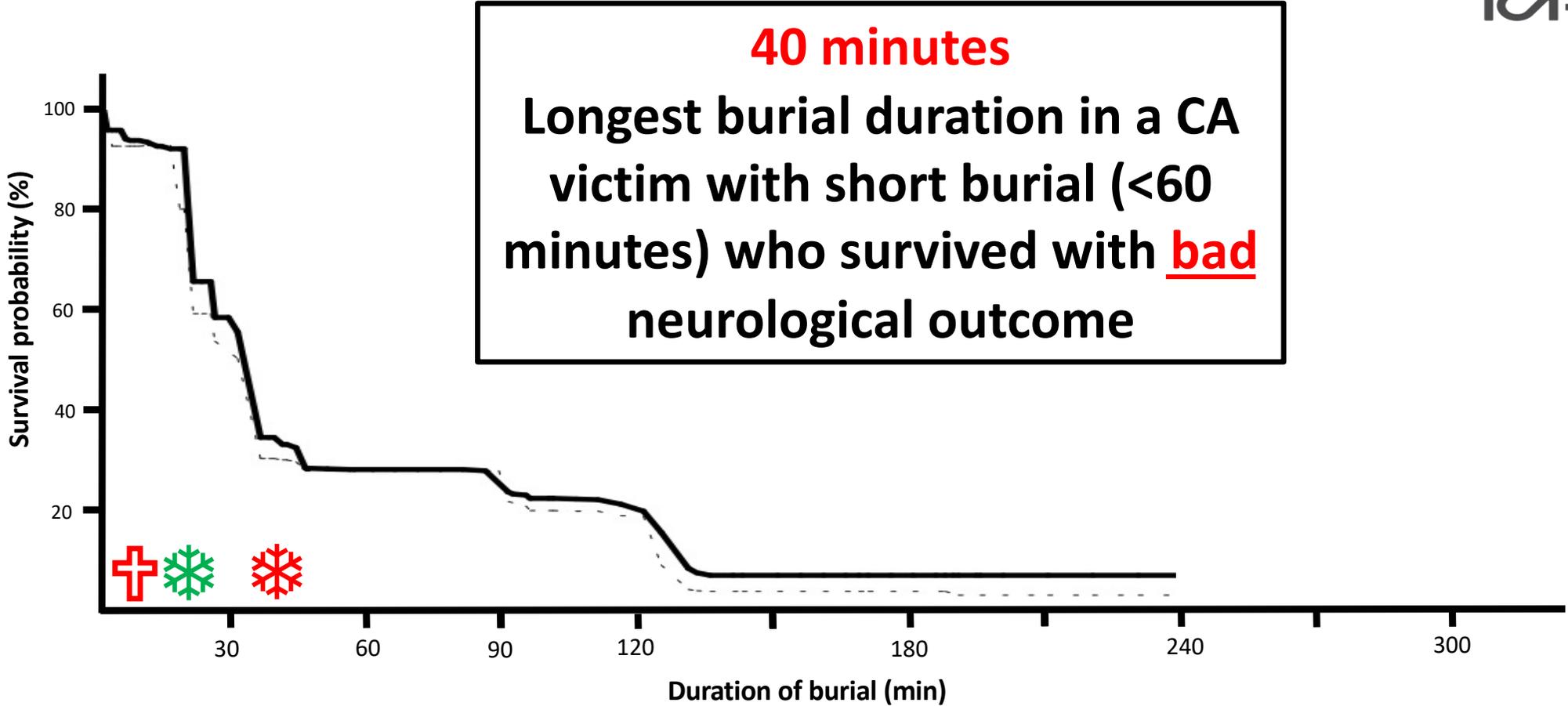
10 minutes
Shortest burial duration resulting
in death from asphyxia



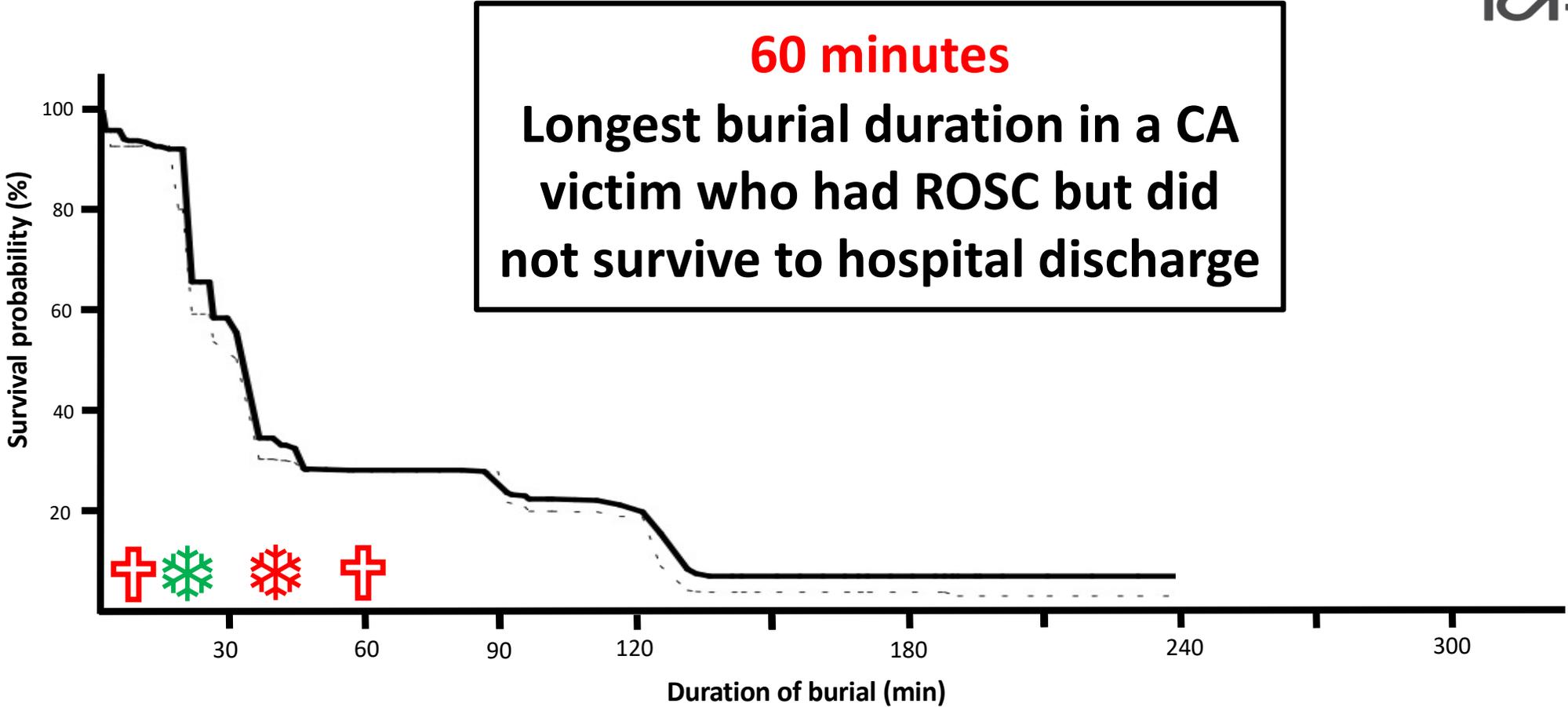
RESULTS: EXTREME CASES



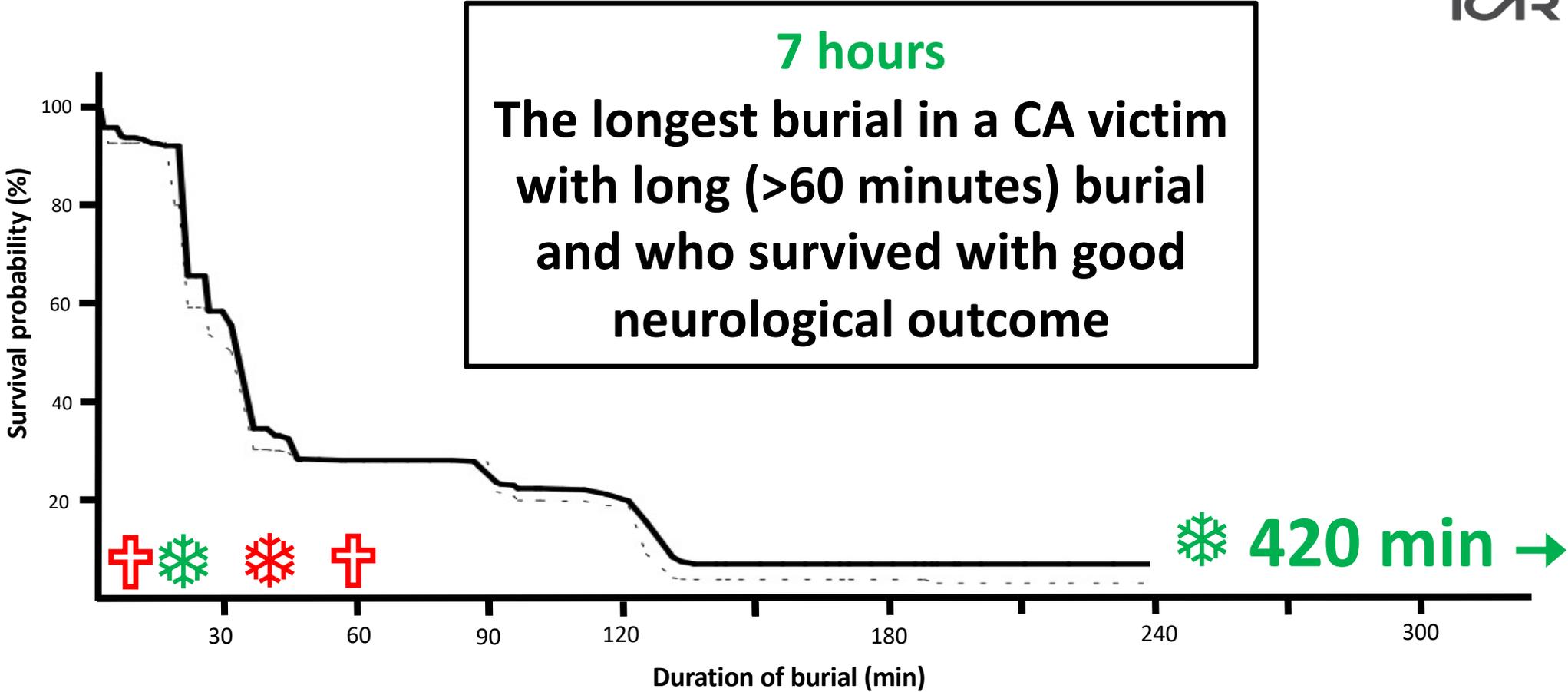
RESULTS: EXTREME CASES



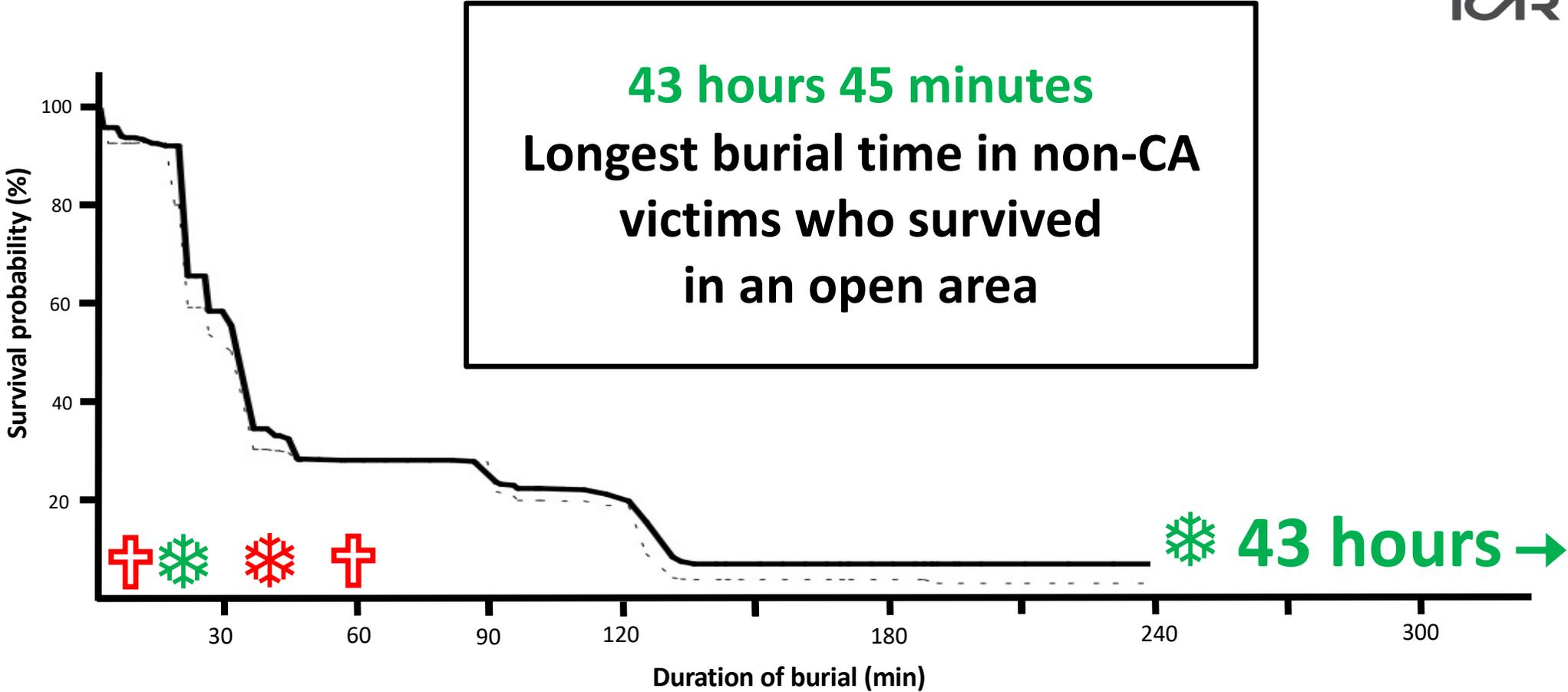
RESULTS: EXTREME CASES



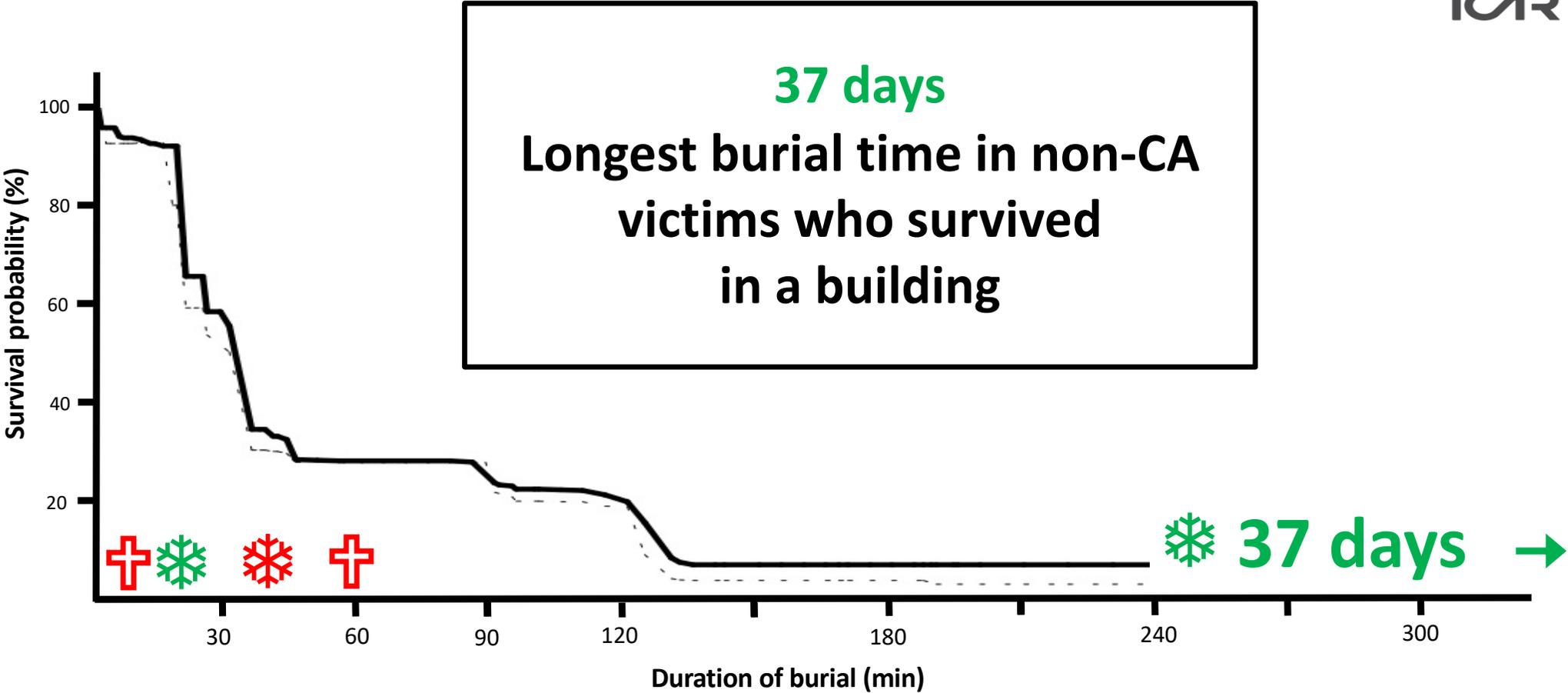
RESULTS: EXTREME CASES



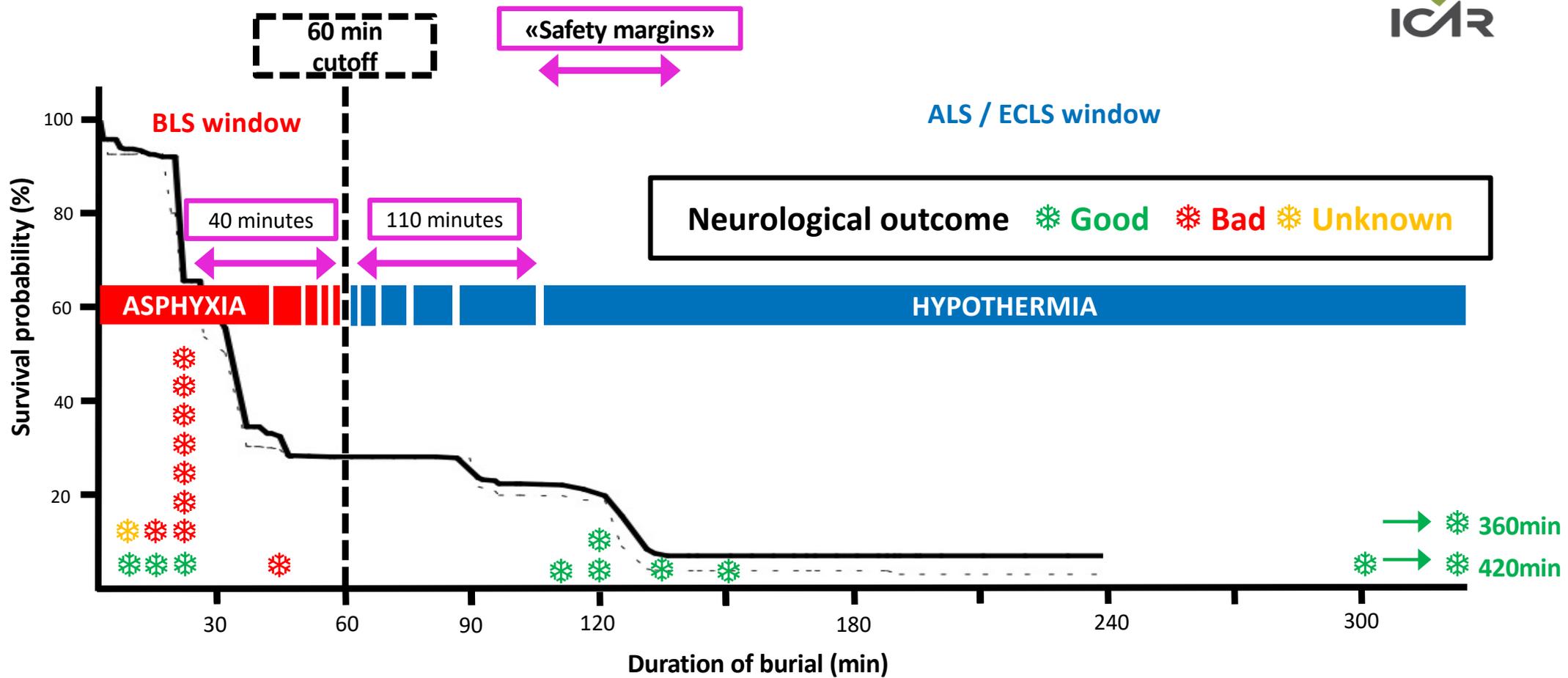
RESULTS: EXTREME CASES



RESULTS: EXTREME CASES



21 survivors of avalanche and CA at extrication for whom burial duration was mentioned



RESULTS: RECOMMENDATIONS



34 recommendations

We recommend that the terminology used to describe the medical aspects of the management of avalanche victims are as follows:

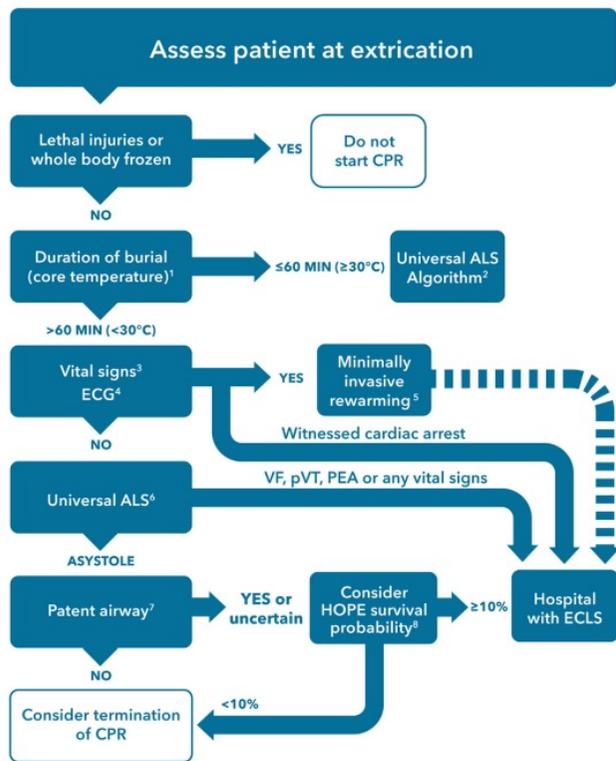
Burial degree:

- The term **critical burial** will be used hereafter to identify burials that impair breathing and therefore risk asphyxia.

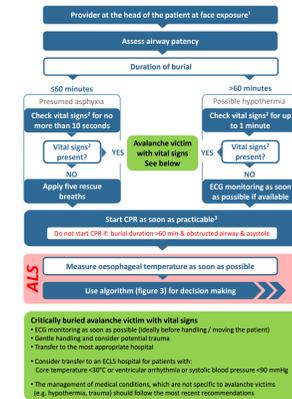
Airway patency:

- The terms of '**obstructed**' or '**blocked**' airway requires that both the mouth and nose are critically filled with compact snow or debris.
- If there is no information about airway patency, the airway should be clinically considered as patent and the victim treated accordingly.

1 ALGORITHM => 2 ALGORITHMS

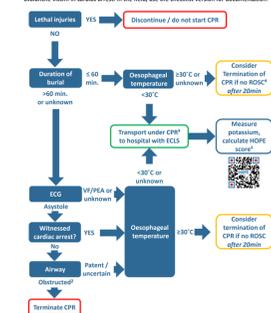


INITIAL MANAGEMENT OF THE CRITICALLY BURIED AVALANCHE VICTIM



DECISION MAKING ALGORITHM FOR ADVANCED MANAGEMENT OF THE CRITICALLY BURIED AVALANCHE VICTIM IN CARDIAC ARREST

Figure 3. Decision making algorithm for advanced management of the critically buried avalanche victim in cardiac arrest. In the field, use the checklist version for decision-making.



INITIAL MANAGEMENT



Provider at the head of the patient at face exposure¹

Assess airway patency

Duration of burial

INITIAL MANAGEMENT



A timely core temperature measurement is recommended in victims buried for >60 minutes with a patent airway and no vital signs

Start CPR as soon as practicable³

Do not start CPR if: burial duration >60 min & obstructed airway & asystole

DECISION MAKING (CARDIAC ARREST)



4. Conclusions

The algorithm for the management of avalanche victims is shown in Fig. 2. If lethal injuries are excluded and the body is not frozen, the rescue strategy is governed by the duration of snow burial and, if not available, by the victim's core-temperature. If burial time ≤ 35 min (or core-temperature $\geq 32^\circ\text{C}$) rapid extrication and standard ALS is indicated. If burial time > 35 min



1. Core temperature may substitute if duration of burial is unknown.

- Core temperature should be used instead of burial duration to determine if victims with a patent airway or unknown and no vital signs may have suffered from a hypothermic CA.

- Cutoffs remain unchanged
 - 30°C for hypothermic cardiac arrest
 - 60 minutes for a long vs short burial duration

DECISION MAKING (CARDIAC ARREST)



Assess airway patency



Duration of burial



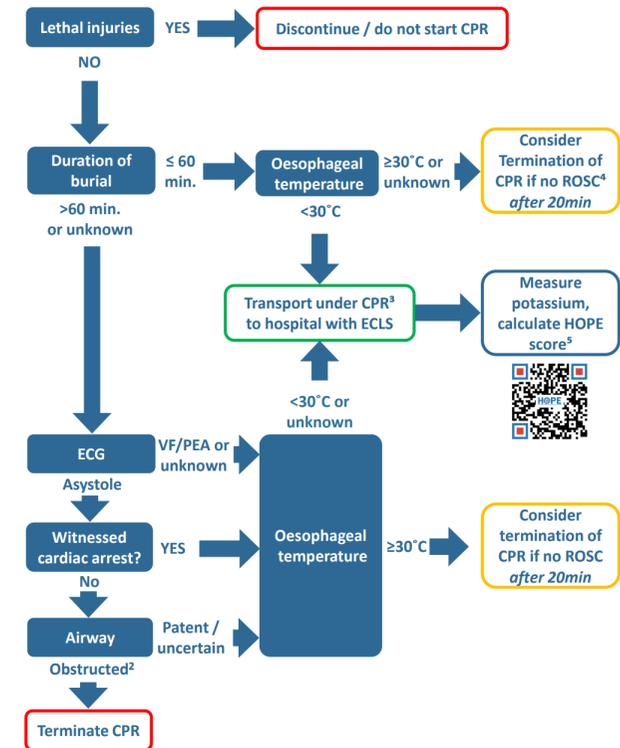
ECG monitoring as soon as possible if available



Measure esophageal temperature as soon as possible



Figure 3. Decision making algorithm for advanced management of the critically buried avalanche victim in cardiac arrest. in the field, use the checklist version for documentation.



DECISION MAKING (CARDIAC ARREST)



**Transport under CPR
to hospital with ECLS**

- Temperature $<30^{\circ}\text{C}$
- Burial duration > 60 minutes if temperature unknown and one of the following:
 - Airway patent / uncertain
 - VF / PEA / rhythm unknown
 - Witnessed CA

**Consider
termination
of CPR if no ROSC
after 20min**

- Temperature $\geq 30^{\circ}\text{C}$
- Burial duration ≤ 60 minutes and temperature unknown

**Do not start /
terminate CPR**

- Lethal injuries
- Burial duration > 60 min & obstructed airway & asystole

Objectives of the checklist

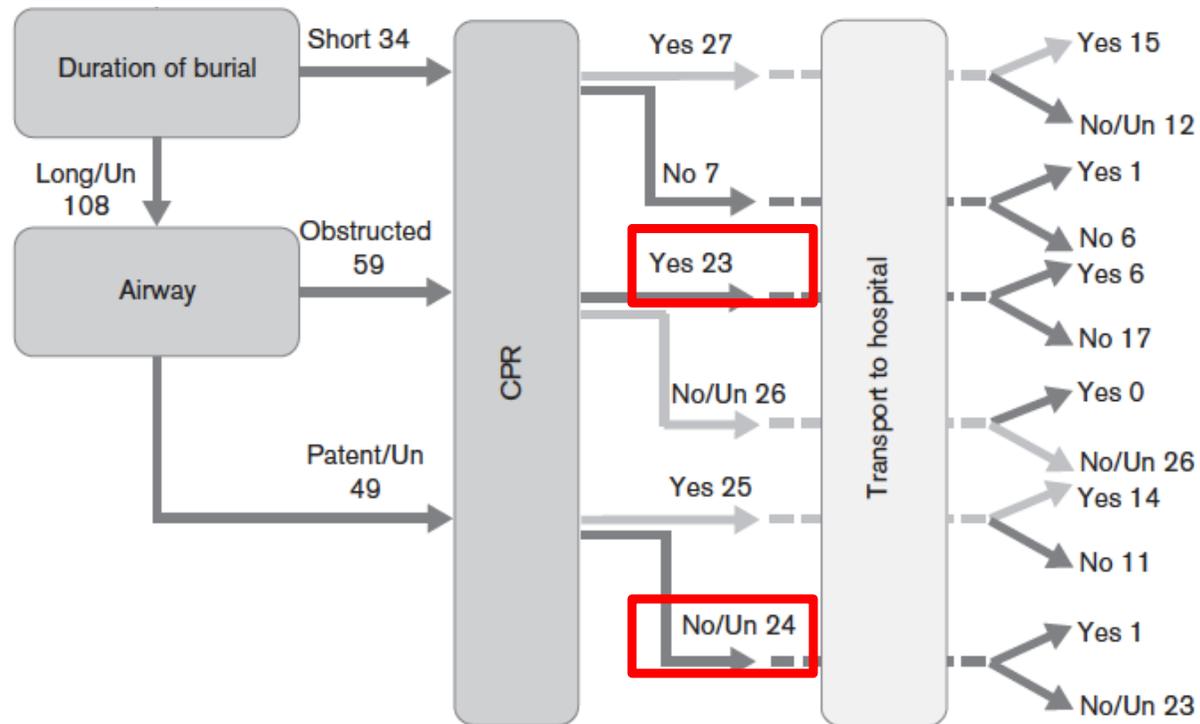
Improve adherence to the algorithm

- increase rate of appropriate resuscitation decision
- decrease rate of futile resuscitation

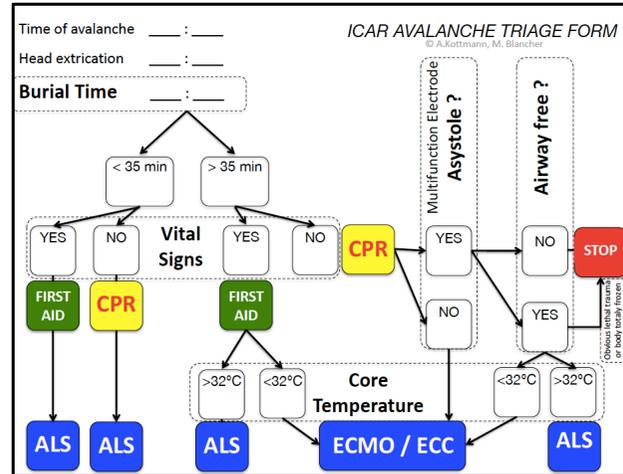
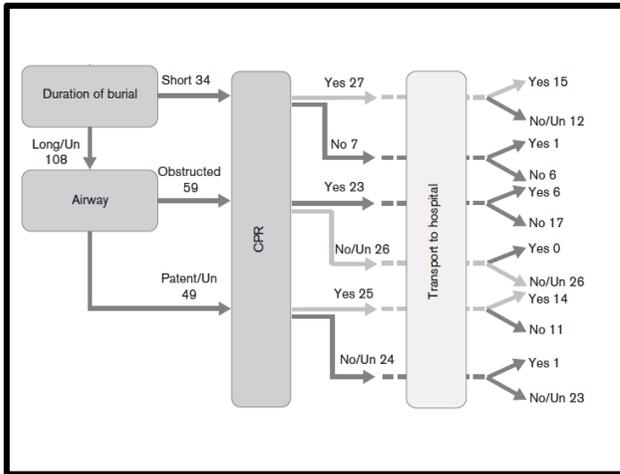
Improve the prehospital documentation

- of the avalanche specific information
- transfer from accident site to the hospital

WAKE UP CALL...

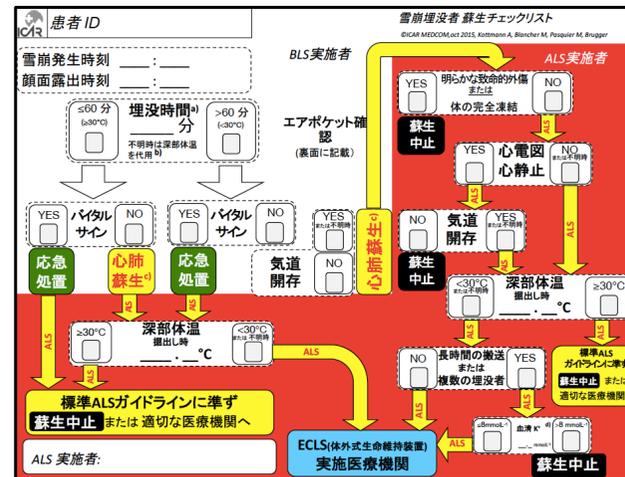


THE STORY OF THE AVRC



Avalanche Victim Resuscitation Checklist
 Changing process for saving lives
 ICAR MEDCOM: Kottmann A, Blancher M, Boyd J, Spichiger T, Brugger H
 Dr. A. Kottmann, rega, alpinerschwyz, EURAC research

Avalanche Victim Resuscitation Checklist
 Teaching presentation Version 1E - generic
 ICAR MEDCOM: Kottmann A, Blancher M, Boyd J, Spichiger T, Brugger H
 rega, alpinerschwyz, EURAC research



EFFECT OF THE USE OF THE AVRC



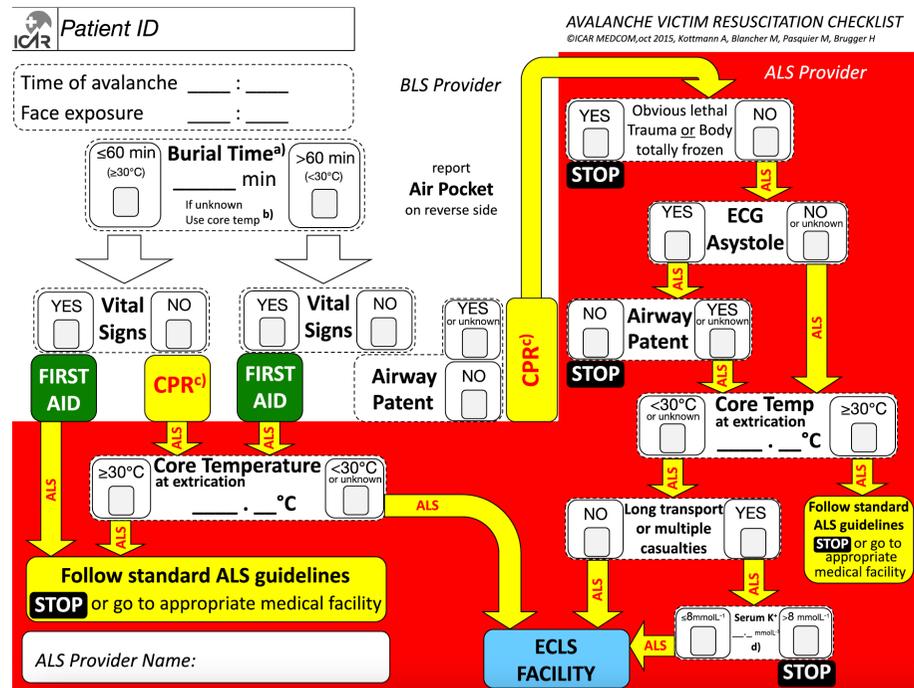
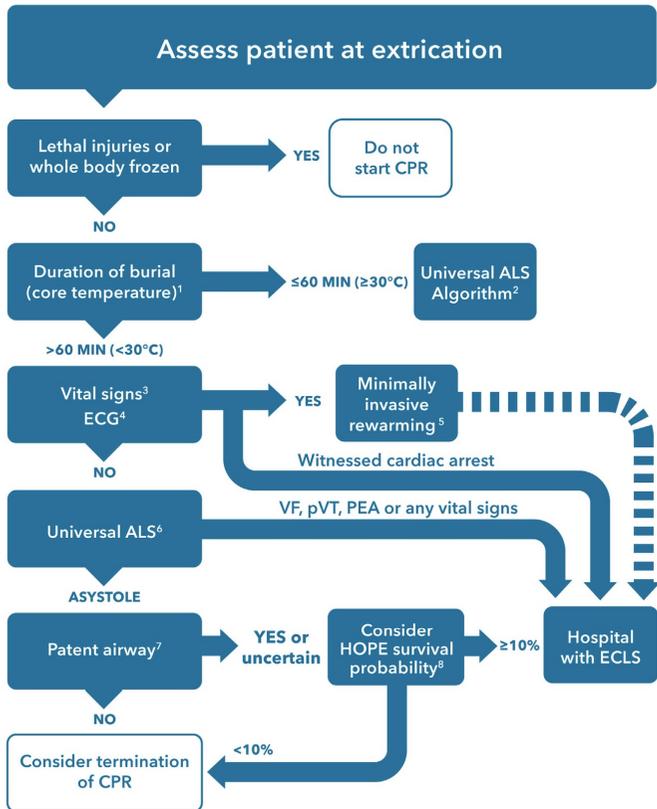
An Avalanche Victim Resuscitation Checklist should be used for every critically buried avalanche victim in cardiac arrest

■ Before AVRC ■ After AVRC, not used ■ With AVRC

AVRC 2.0



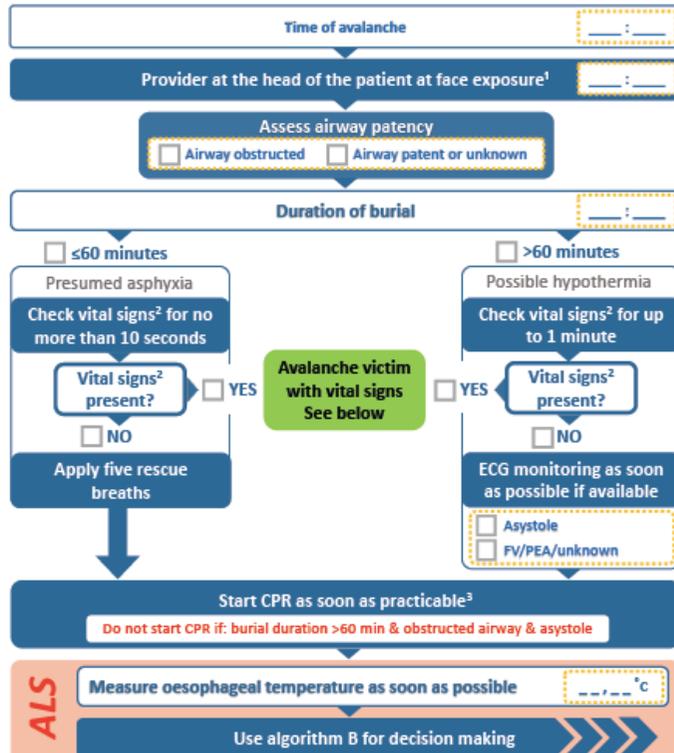
AVALANCHE RESCUE EUROPEAN RESUSCITATION COUNCIL





Patient ID: _____

A. Initial management of the critically buried avalanche victim

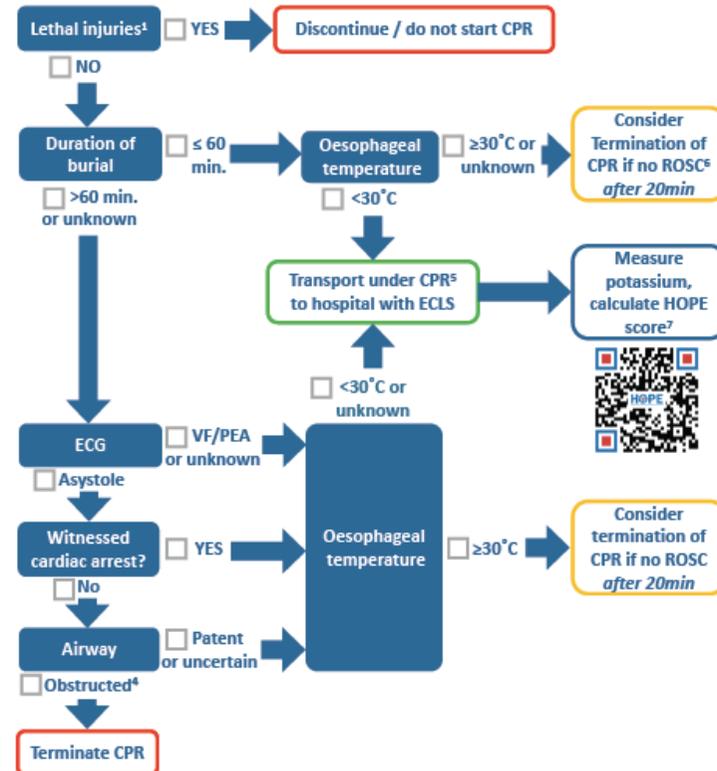


Critically buried avalanche victim with vital signs

- ECG monitoring as soon as possible (ideally before handling / moving the patient)
- Gentle handling and consider potential trauma
- Transfer to the most appropriate hospital
- Consider transfer to an ECLS hospital for patients with:
 - Core temperature $<30^{\circ}\text{C}$ or ventricular arrhythmia or systolic blood pressure <90 mmHg
- The management of medical conditions, which are not specific to avalanche victims (e.g. hypothermia, trauma) should follow the most recent recommendations

Avalanche Victim Resuscitation Checklist

B. Decision making algorithm for advanced management of the critically buried avalanche victim in cardiac arrest.



1. Assess lethal injuries: decapitation; trunical transection; whole body decomposed. If present, do not start CPR.
 2. Breathing, responsiveness (and carotid pulse for experienced ALS providers).
 3. Standard compression / ventilation rates. Drug dose and defibrillation depending on core temperature or, if not available, burial duration. If ventricular fibrillation persists after three shocks, delay further attempts until the core temperature is $\geq 30^{\circ}\text{C}$. Withhold adrenaline if the core temperature is $< 30^{\circ}\text{C}$.
 4. An "obstructed" or "blocked" airway requires both the nose and mouth are critically filled with compact snow or debris.
 5. With a deeply hypothermic patient ($< 28^{\circ}\text{C}$), consider delayed CPR if rescue is too dangerous and intermittent CPR with difficult transport.
 6. If core temperature measurement is not available, hypothermic CA may be considered, at the rescuer's discretion, despite a burial duration of ≤ 60 minutes in a victim with a patent airway and no vital signs where there is a possibility of very fast cooling (e.g. burial during ascent, slippy and small person, minimally dressed, sweating before burial).
 7. If any doubt exists whether the avalanche victim may have asphyxiated despite critical burial, the HOPE score should be calculated using the NON-ASPANA option. This will lower the risk of under-treatment. If the HOPE score cannot be determined, the combination of a potassium < 7 mmol/L, and a temperature $< 30^{\circ}\text{C}$ should be used to estimate the chances of survival after ECLS rewarming.

SUMMARY



- Simplification
- Easier for first line providers
- Usable by both BLS and ALS
- Not blocking
- Emphasize on the treatment of asphyxia
- Improved detection of patients with deep hypothermia
- Next step:
 - Approval algorithm by AOD
 - Completion of the scientific paper
 - Checklist available end 2022?