

Presentation to HEMS NZ: AvaLife

20 June 2022



ISMM
International Society
for Mountain Medicine



KAITIAKI ORA
TACTICAL MEDICINE NEW ZEALAND

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NZ SAR Avalanche readiness guidelines 2022

NEW ZEALAND
SEARCH AND RESCUE
Rapu Whakarauora Aotearoa



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Low incidence, high consequence

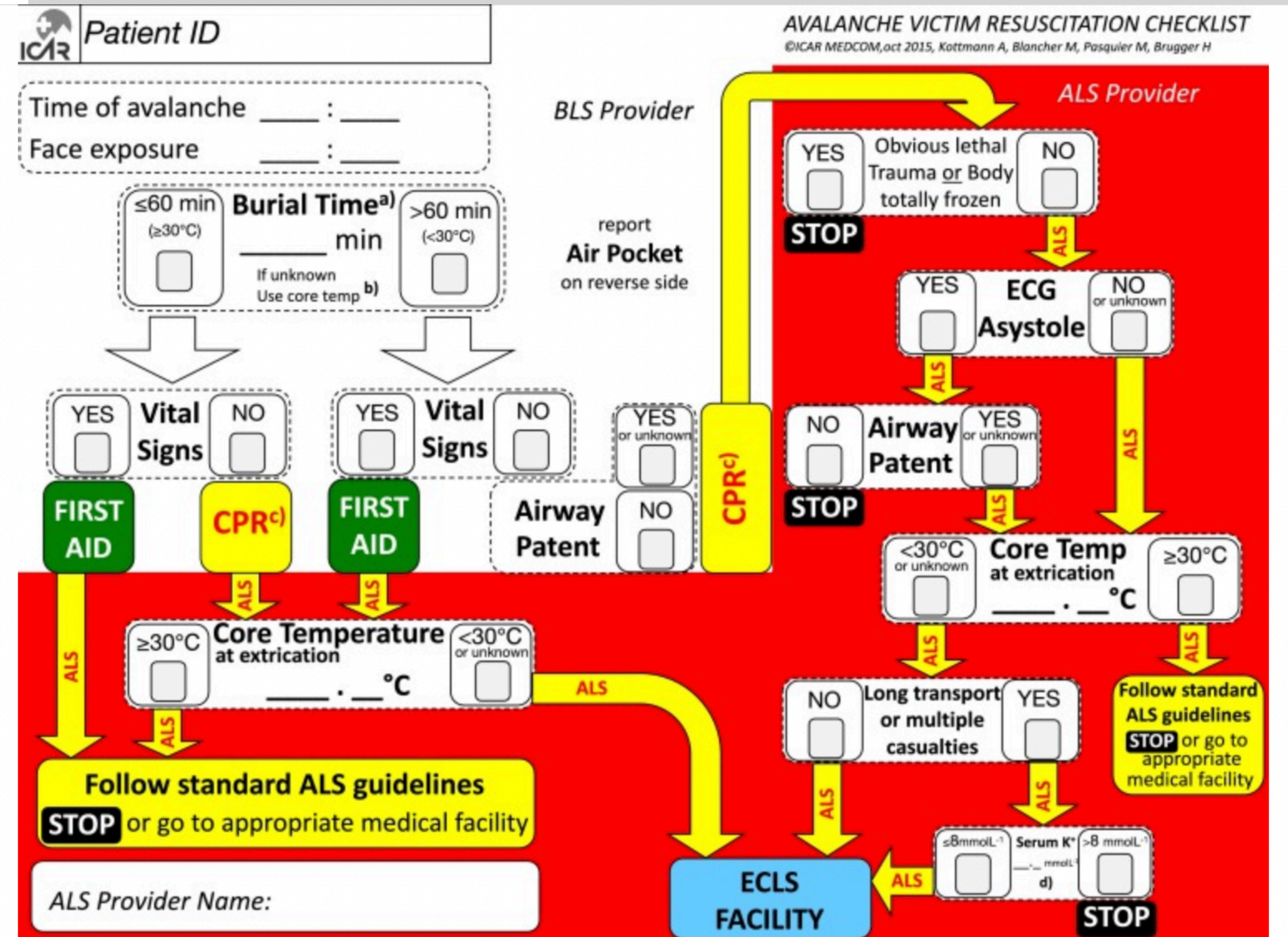
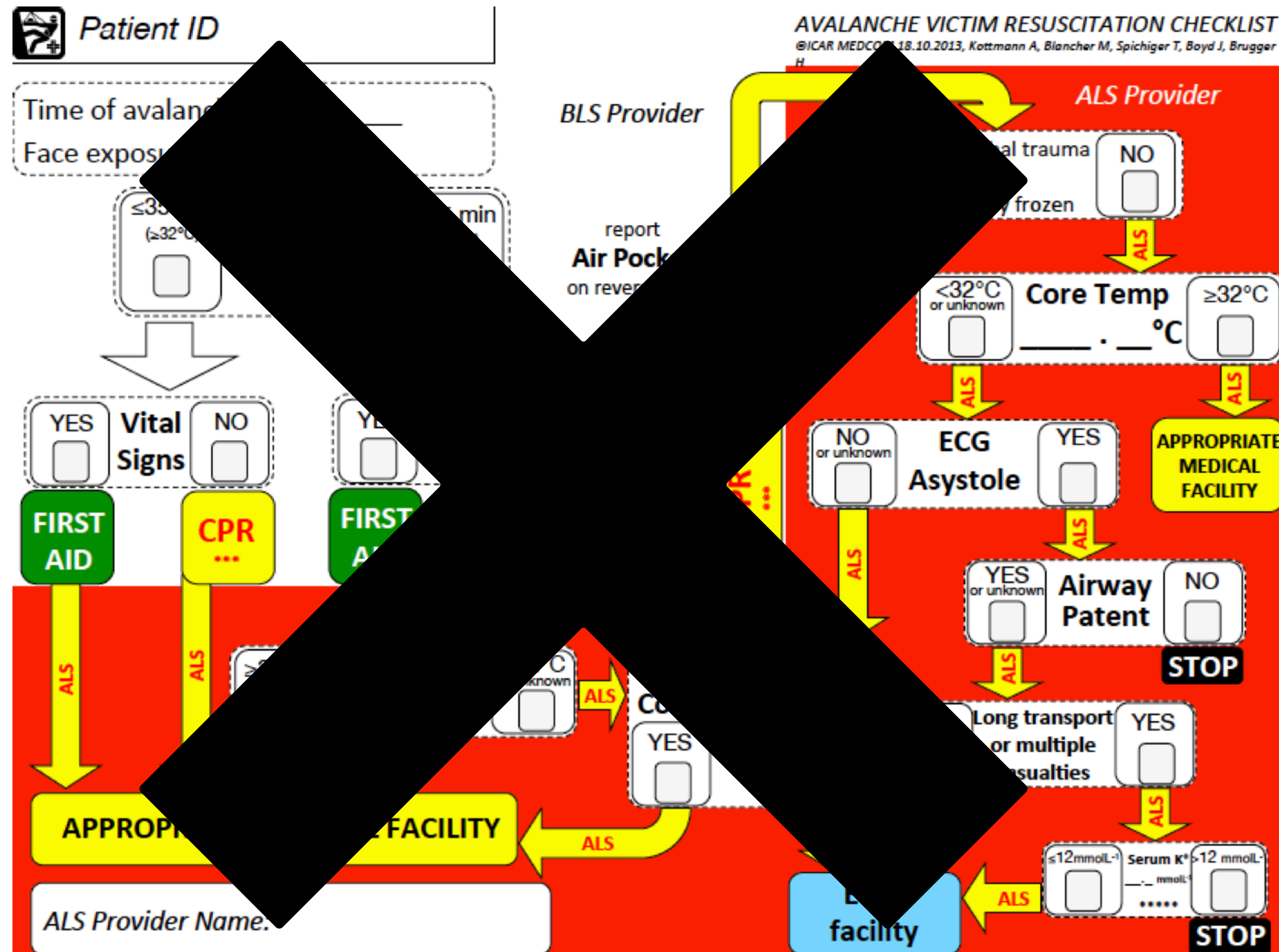
- Rare
- Potentially high risk for rescuers
- **Projected increased** incidence
- Likely Mass Casualty Incident
- **C**ompanion rescuers
- Remote reverse triage
- Atypical survival chances

Time critical rescue

- **Physiology** 
- **Epidemiology** 
- **Insight into what insitu/ immediate responders know & do** 
- **Triage & reverse remote triage** 
- **Cessation/ continuation of resuscitative efforts** 
- **Transport priorities** 
- **Destination policies** 

2013

2015

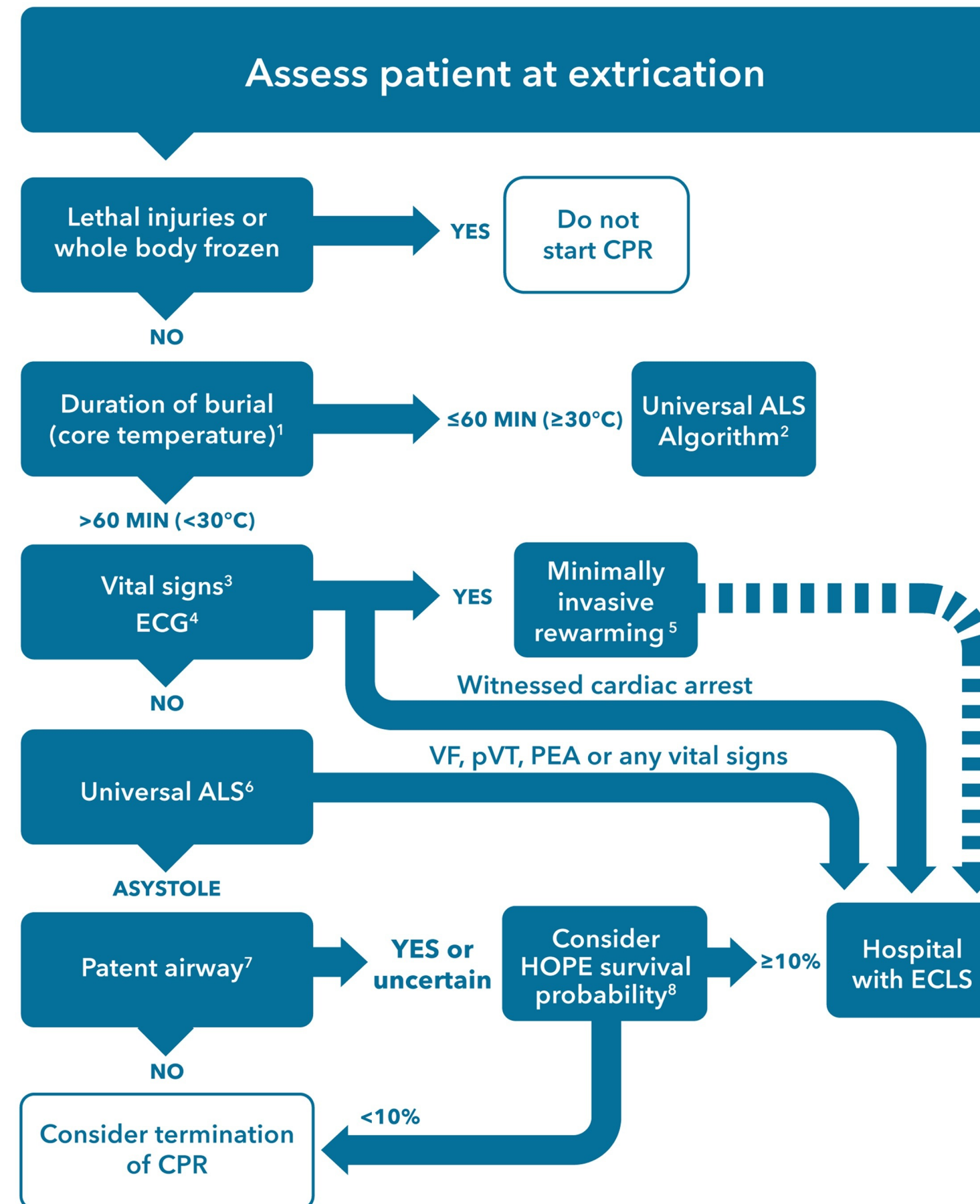


St John CPG p 383 2019-2022

- Continue with treatment and CPR if the patient has been in an avalanche, unless:
 - a) The chest is incompressible, or
 - b) There are visible injuries incompatible with life, or
 - c) The rhythm is asystole and the airway was completely occluded by snow/ice at the time of extrication.

- e) Have the following additional information available if the patient has been in an avalanche:
 - The known or estimated time buried.
 - The core temperature if this is able to be measured.
 - Whether an air pocket was present in front of the face when extricated.
 - Whether the airway was completely occluded by snow/ice at the time of extrication.

2021



1. Core temperature may substitute if duration of burial is unknown.
2. Transport patient with injuries or potential complications (e.g. pulmonary oedema) to the most appropriate hospital.
3. Check for spontaneous breathing, pulse and any other movements for up to 60 seconds.
4. Use additional tools for detection of vital signs (end-tidal CO₂, arterial oxygen saturation (SaO₂), ultrasound) if available.
5. Transport patients with core temperature <30°C, systolic blood pressure <90mmHg or any other cardiocirculatory instability to a hospital with ECLS.
6. With deeply hypothermic patient (<28°C) consider delayed CPR if rescue is too dangerous and intermittent CPR with difficult transport.
7. If airway is patent, the additional presence of an air pocket is a strong predictor for survival.
8. If HOPE is not possible, serum potassium and core temperature (cut-offs 7 mmol/L and 30°C) can be used but may be less reliable

Abbreviations: ALS Advanced life support, CPR cardiopulmonary resuscitation, ECLS extracorporeal life support, PEA pulseless electrical activity, pVT pulseless ventricular tachycardia, SaO₂ arterial oxygen saturation, VF ventricular fibrillation

St John CPG do not advocate for any resuscitation if airway obstructed (irrespective of burial duration)

In AvaLife this depends on resources available, CPR limited to 6 minutes in some cases

AvaLife BLS



AvaLife BLS+ & ALS

Search



AvaLife BLS+ & ALS

Excavate:




Image credit: Mountain Safety. Info

2022 AvaLife v.36 BLS+ ski patrol, guides & ACR

Search & excavate

Hypothermia staging Intermittent CPR


Version 36
EN 05

Search and Excavate

```

graph TD
    Start[Avalanche Accident - Start here! (1)] --> Q1{Subjects visible on surface?}
    Q1 -- YES --> E1[Excavate head and chest only (3)]
    Q1 -- NO --> S[Search! Prioritize most likely burial areas, terrain with increased probability of survival (no trees, no high fall, no crevasses or seracs) and buried subjects with increased survival chances indicated by vital data of the transceiver.]
    S --> Q2{Burial depth >= 1.5m? (2)}
    Q2 -- NO --> E1
    Q2 -- YES --> Q3{Are all buried subjects currently being excavated?}
    Q3 -- YES --> E1
    Q3 -- NO --> Q4{2 or more rescuers per remaining buried subject?}
    Q4 -- YES --> E1
    Q4 -- NO --> S
    E1 --> End[Proceed to Out-Of-Hospital Medical Treatment chart]
            
```

(1) Consider risk of rescuers and residual survival chances of buried subjects. Consider helicopter-based search and helicopter-attached "scoop and run" excavation. Limit number of exposed rescuers, use additional personal protection equipment, mitigate danger or postpone rescue if survival chances of the buried subjects are low compared to the risk of the rescue mission.

(2) Excavate immediately regardless of burial depth if finding additional buried subjects is unlikely, requires probe lines, or a similarly time-consuming search.

(3) Consider immediate evacuation in case of:
 1. Considerable risk for rescue personnel,
 2. Risk of delayed evacuation due to deteriorating weather or flying conditions,
 3. Terrain conditions which make effective on-site treatment impossible.

Hypothermia Staging

Hypothermia Staging Revised Swiss System

Stage	Symptoms	Measures
1	Alert, clear answers	Active rewarming by moving, warm sugary drinks
2	Impaired consciousness, responds to verbal stimulation	Avoid further cooling, move carefully, warm sugary drinks
3	Unconscious, signs of life might be minimal	Avoid further cooling, move carefully, monitor
4	No signs of life	Apply AvaLife Out-Of-Hospital Medical Treatment algorithm

The colder the patient:
 - The less heat production (due to reduced metabolism)
 - The lower the level of consciousness
 - The higher the risk of hypothermic cardiac arrest
 - The more severe the hypothermia stage
 -> **Avoid further cooling!**

iCPR

Intermittent CPR: Mean of Last Resort!
 ONLY apply if transport is unavoidable and effective CPR impossible, or in cases where continuous CPR is impossible because of extremely limited resources.

Burial duration	Measures
≤ 60 min	No intermittent CPR, preferably apply mCPR
> 60 min: Before ICPR, ALWAYS perform uninterrupted CPR for 1/3 of the burial duration	At least 5 min of CPR followed by max 5 min without CPR

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Survival Chance Optimized Procedures in Rescue and How to Minimize Injuries During Excavation; Geneswein M, ISSW2013; 1408-1417. | A concept for optimizing avalanche rescue strategies using a Monte Carlo simulation approach; Reiweger J, Geneswein M, Paal P, Schweizer J (2017); PLoS ONE 12(5): e0175877. <https://doi.org/10.1371/journal.pone.0175877> | Hypothermia outcome prediction after extracorporeal life support for hypothermic cardiac arrest patients: The HOPE score; Pasquier M, Hagli Q, Paal P, Darocha T, Blancher M, Husby P, Sillvaest T, Carron P N, Rousson V (2018); Resuscitation, 2018 May; 126:58-64. doi: 10.1016/j.resuscitation.2018.02.026. Epub 2018 Mar 2. | Hypothermia outcome prediction after extracorporeal life support for hypothermic cardiac arrest patients: An external validation of the HOPE score; Pasquier M, Rousson V, Darocha T, Bouzaf P, Kowinski S, Sawamoto K, Champigneulle B, Wiberg S, Wrancher MCJ, Brodmann-Maeder M, Paal P, Hagli Q (2019); Resuscitation, 2019 Mar 10; pii: S0300-9572(19)30066-3. doi: 10.1016/j.resuscitation.2019.03.017. | Guidelines for Cardiac arrest in special circumstances 2020; Lott C, Truhlar A, Alfonzo A, Barelli A, Gonzalez-Salvado Y, Henkelstein J, Nolan J, Paal P, Perkins G D, Thies K-C, Yeung J, Zideman D A, Soar J (2020); European Resuscitation Council 2020.

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ALS

Search & excavate

Hypothermia staging

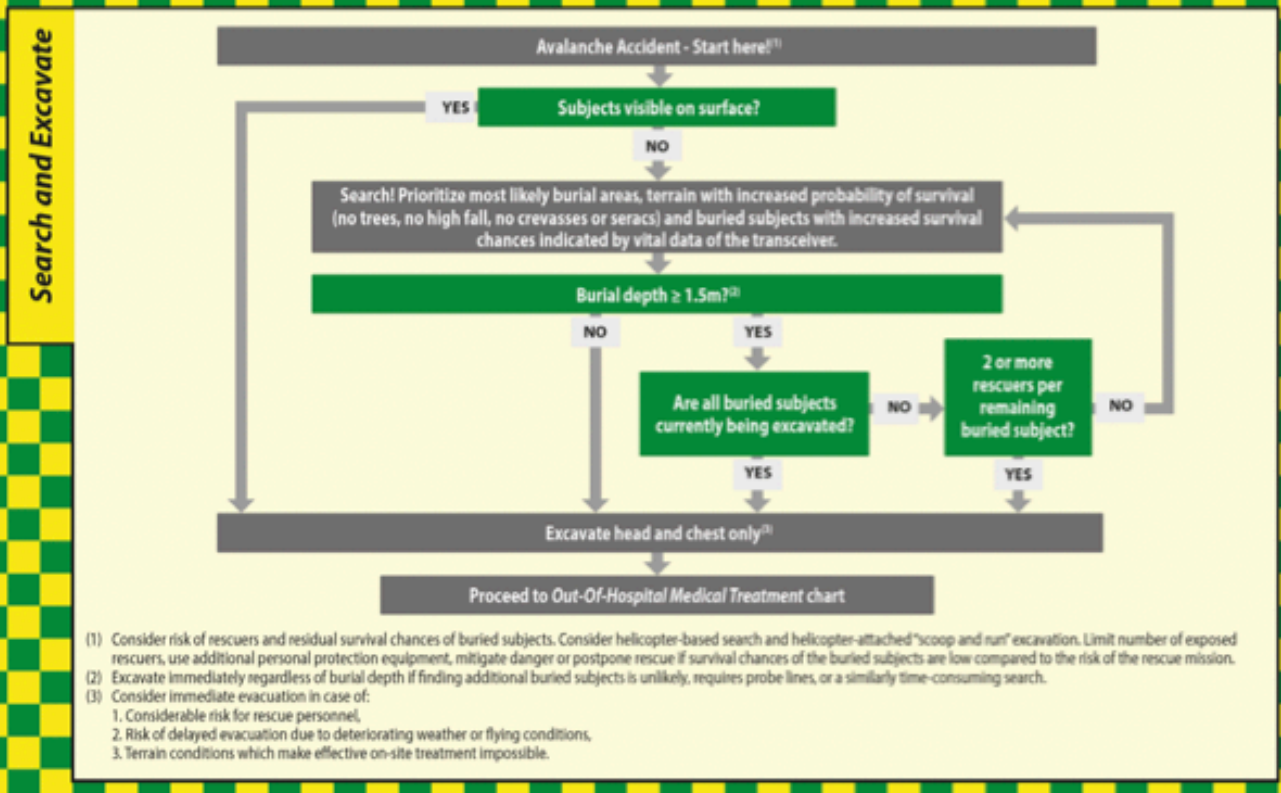
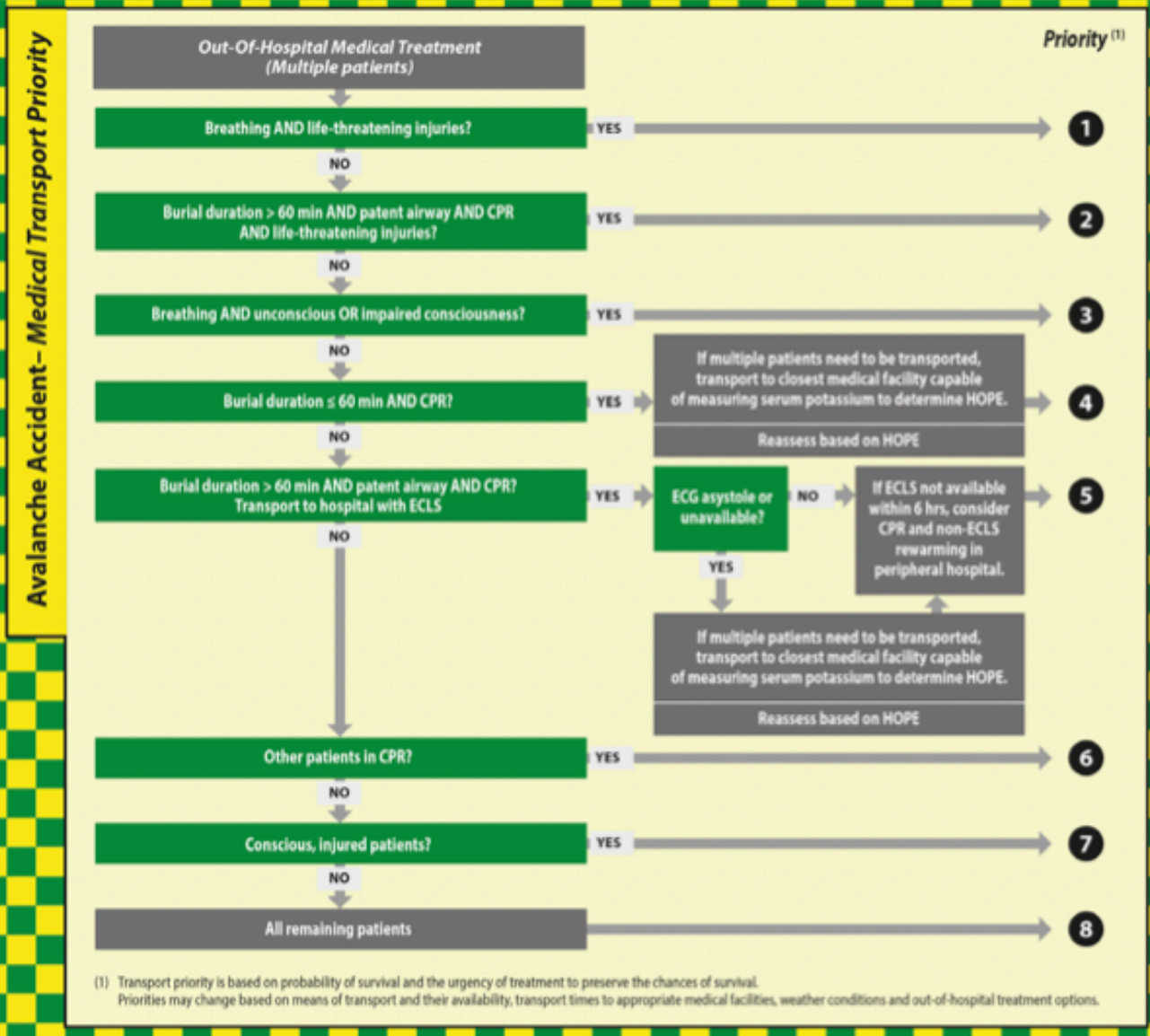
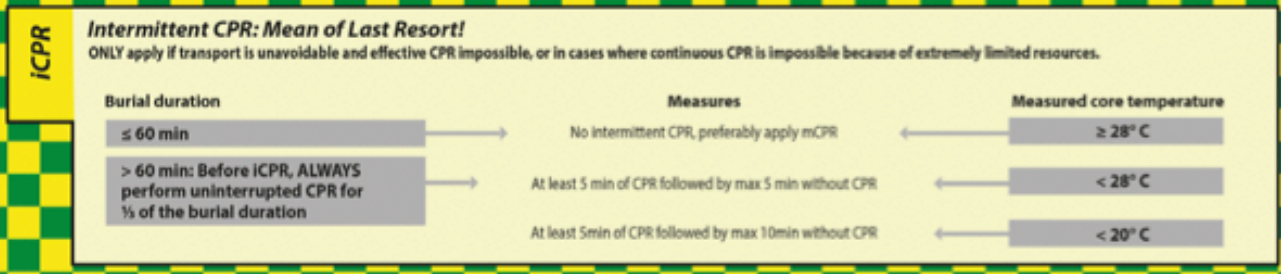
Intermittent CPR

Medical transport priority

Hypothermia Staging Core Temperature and Revised Swiss System

Stage	Measured core temperature	Symptoms	Measures
1	35 - 32° C	Alert, clear answers ⁽¹⁾	Active rewarming by moving, warm sugary drinks
2	< 32 - 28° C	Impaired consciousness, responds to verbal stimulation ⁽¹⁾	Avoid further cooling, move carefully, warm sugary drinks
3	< 28° C	Unconscious, signs of life might be minimal ⁽¹⁾	Avoid further cooling, move carefully, monitor
4	Variable ⁽²⁾	No signs of life	Apply AvaLife Out-Of-Hospital Medical Treatment algorithm

(1) Consciousness may be impaired by trauma or drugs.
(2) Hypothermic cardiac arrest in young, healthy persons occurs < 30° C, in older persons and persons with pre-existing diseases already < 32° C. Some persons still have vital signs < 24° C.



Resuscitate:



Ski terrain- snow burial

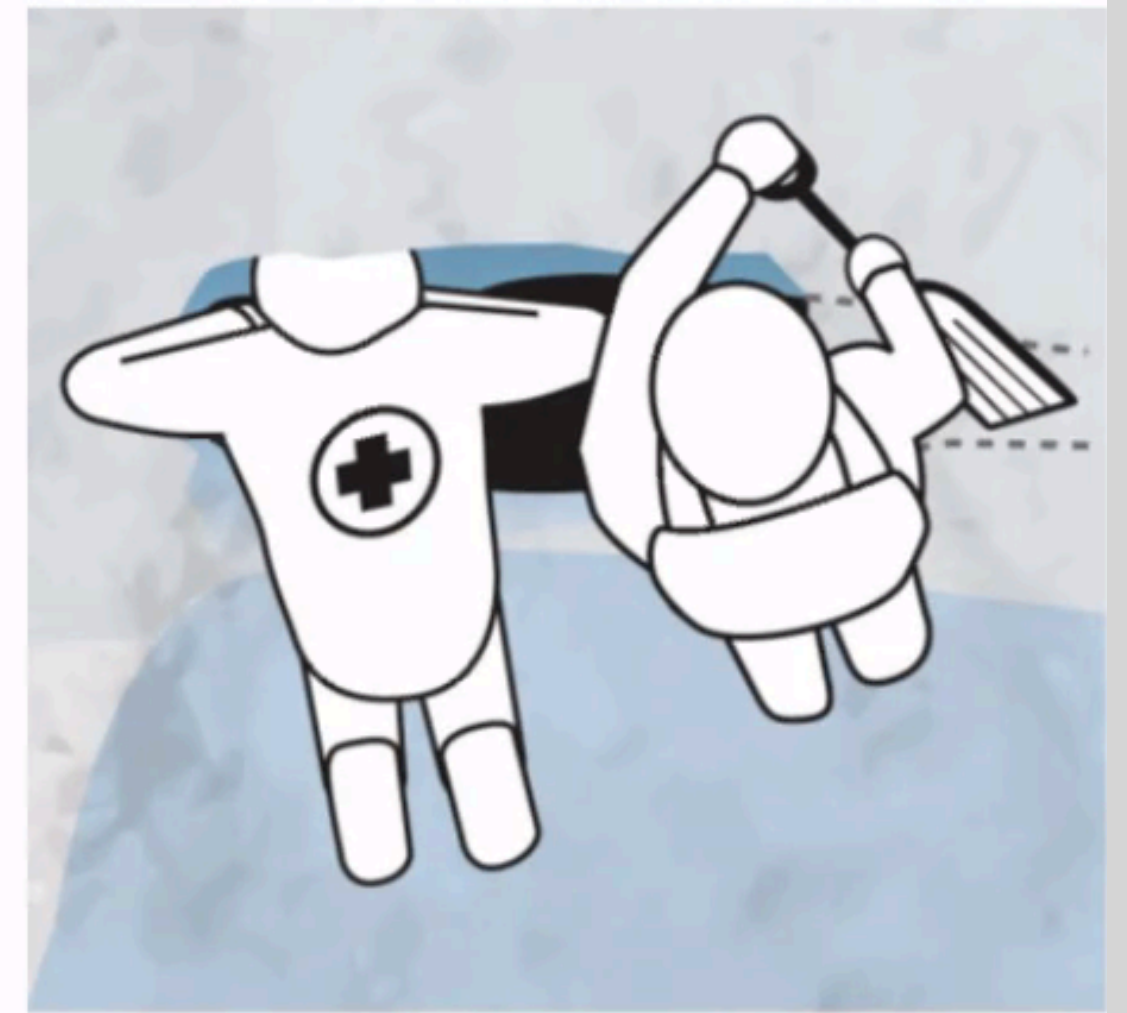
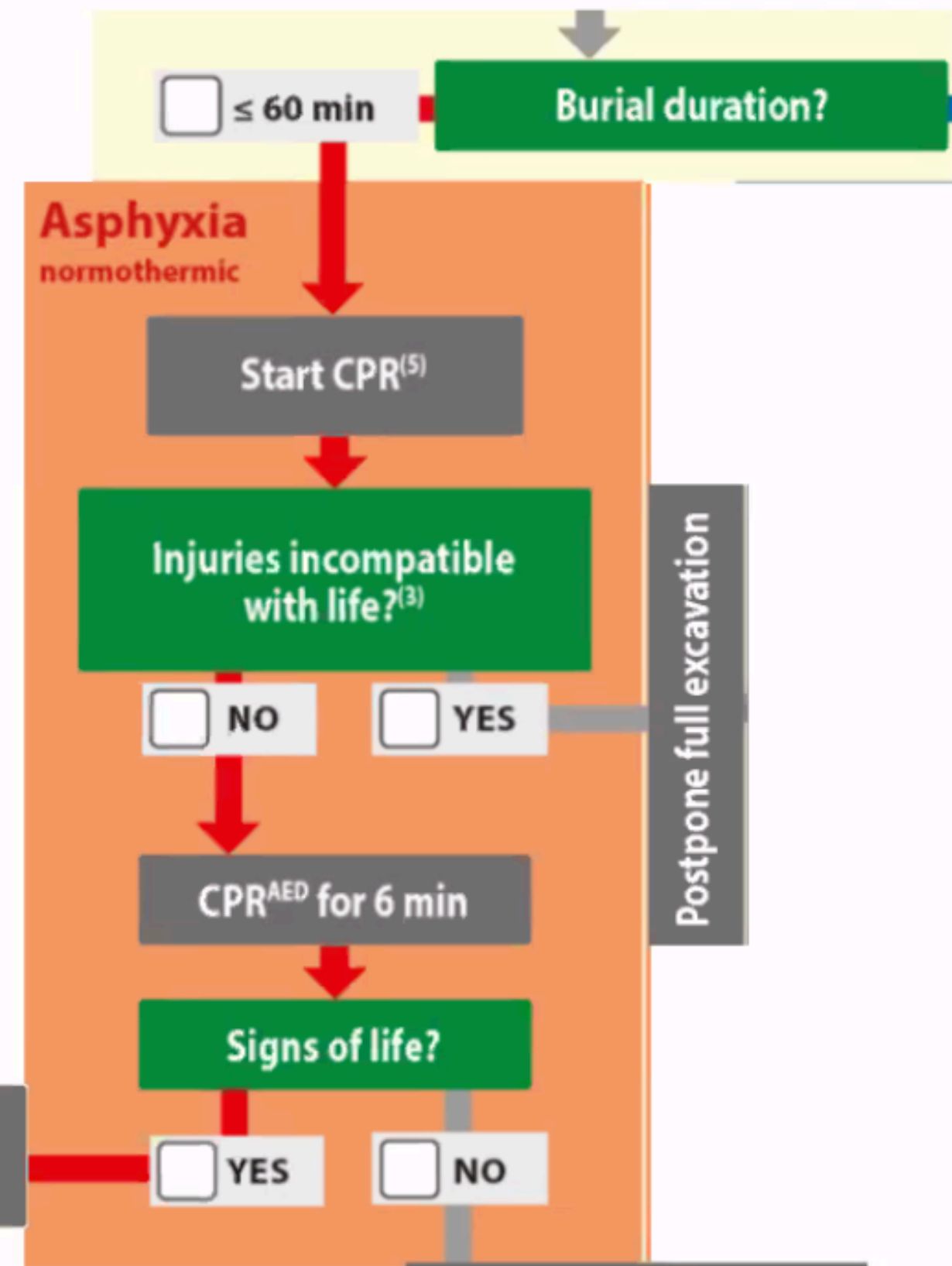
Please note, this is an oversimplification



Climbing terrain- poly trauma

Please note this is an oversimplification

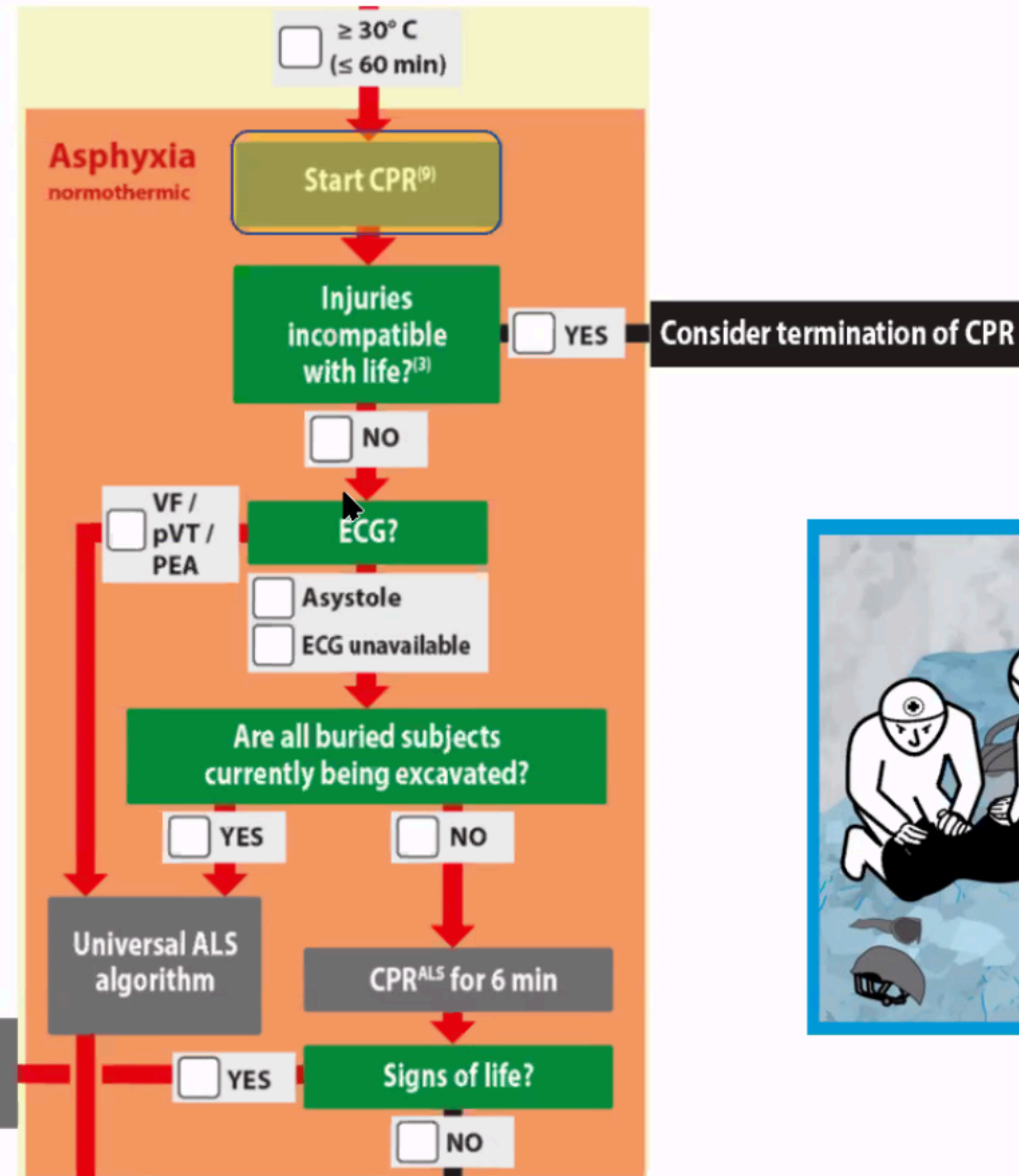
AvaLife Out-Of-Hospital-Medical Treatment (Asphyxia, normothermic)



Full excavation; check and first aid for all patients as required. Avoid further cooling, CPR⁽⁴⁾ for patients in cardiac arrest.

Postpone full excavation

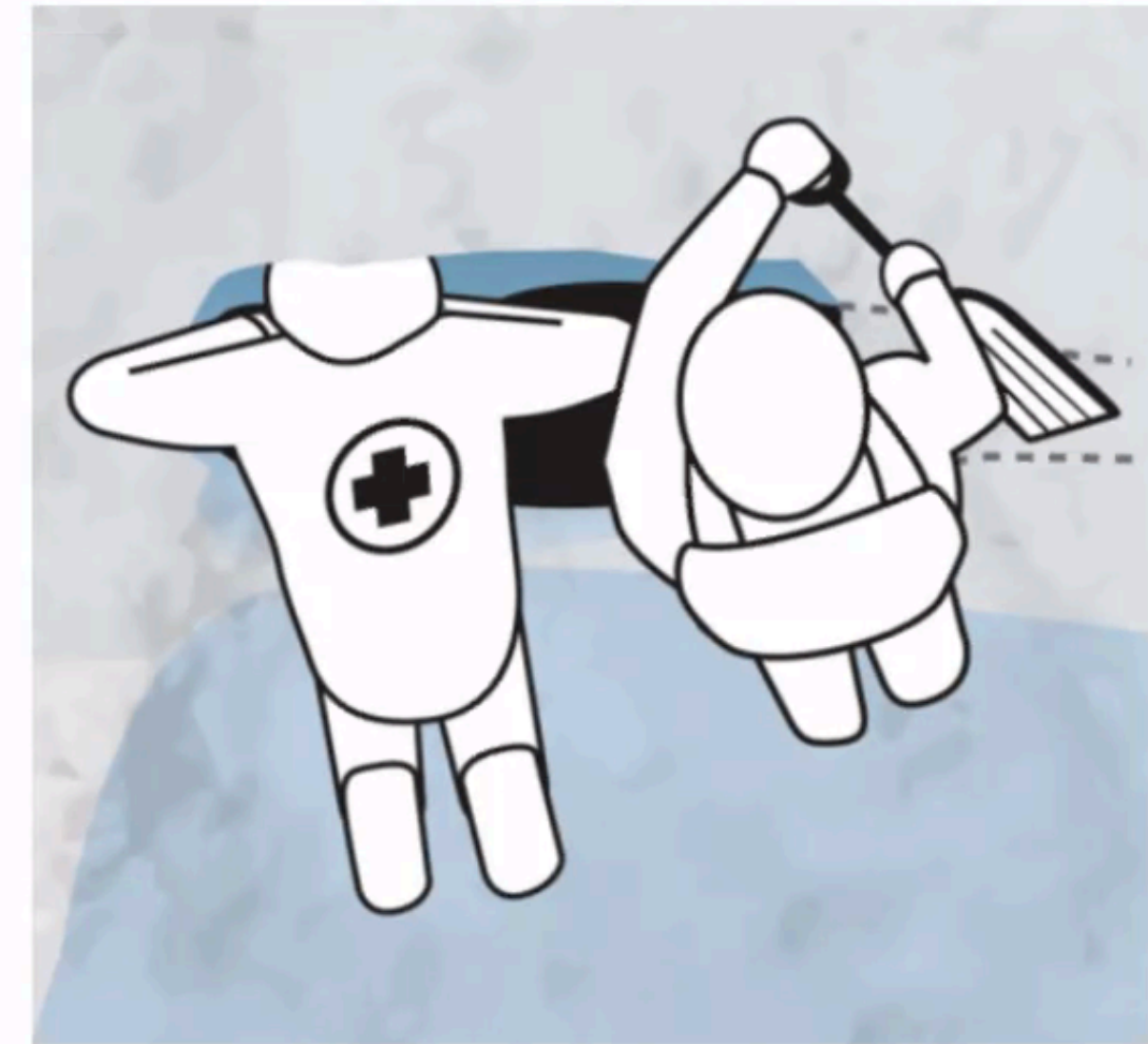
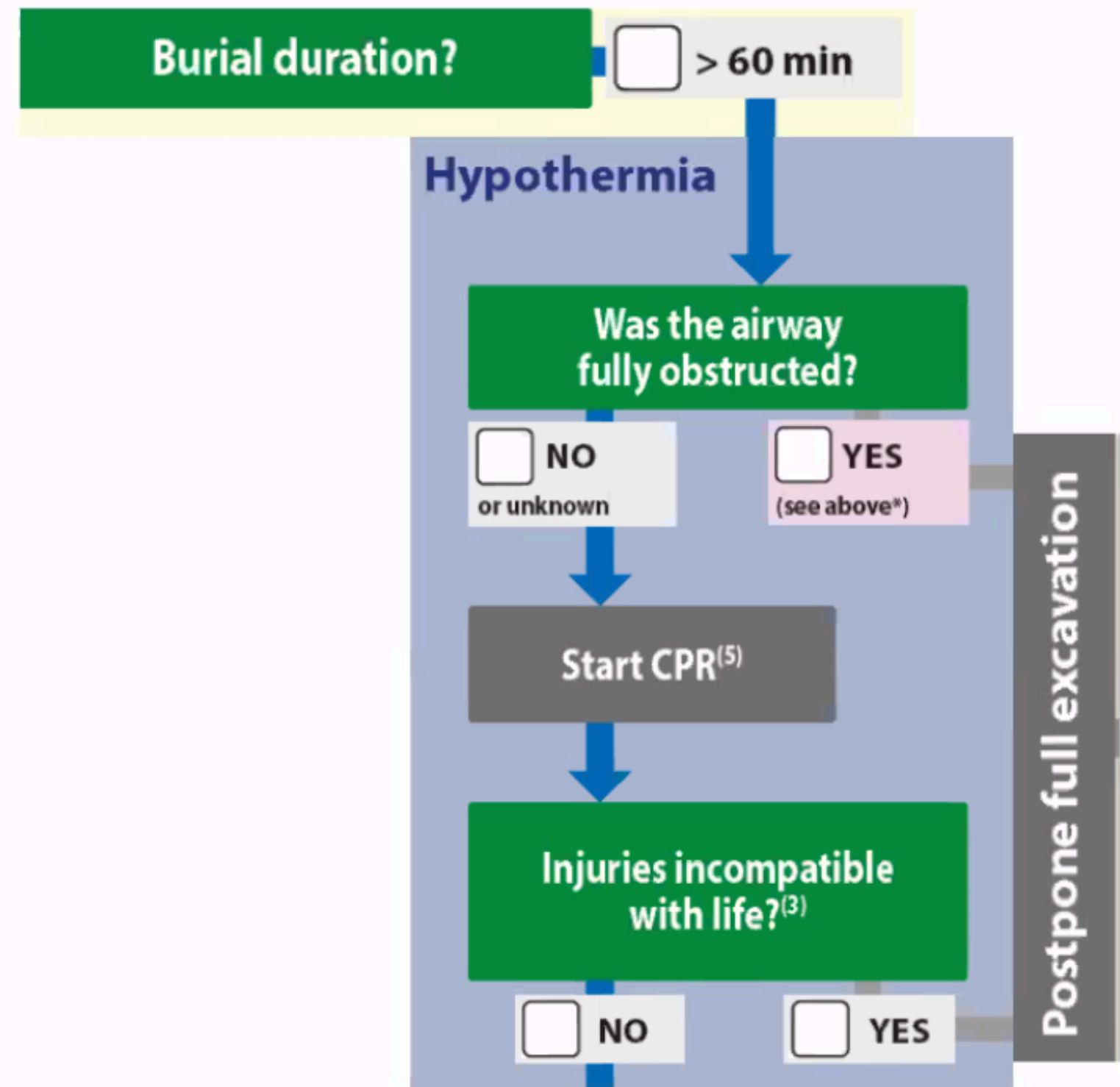
AvaLife Out-Of-Hospital-Medical Treatment (Asphyxia, normothermic)



Full excavation; check, monitor and treat all patients as required. Avoid further cooling, CPR⁽⁷⁾ or mechanical CPR (mCPR) for patients in cardiac arrest.

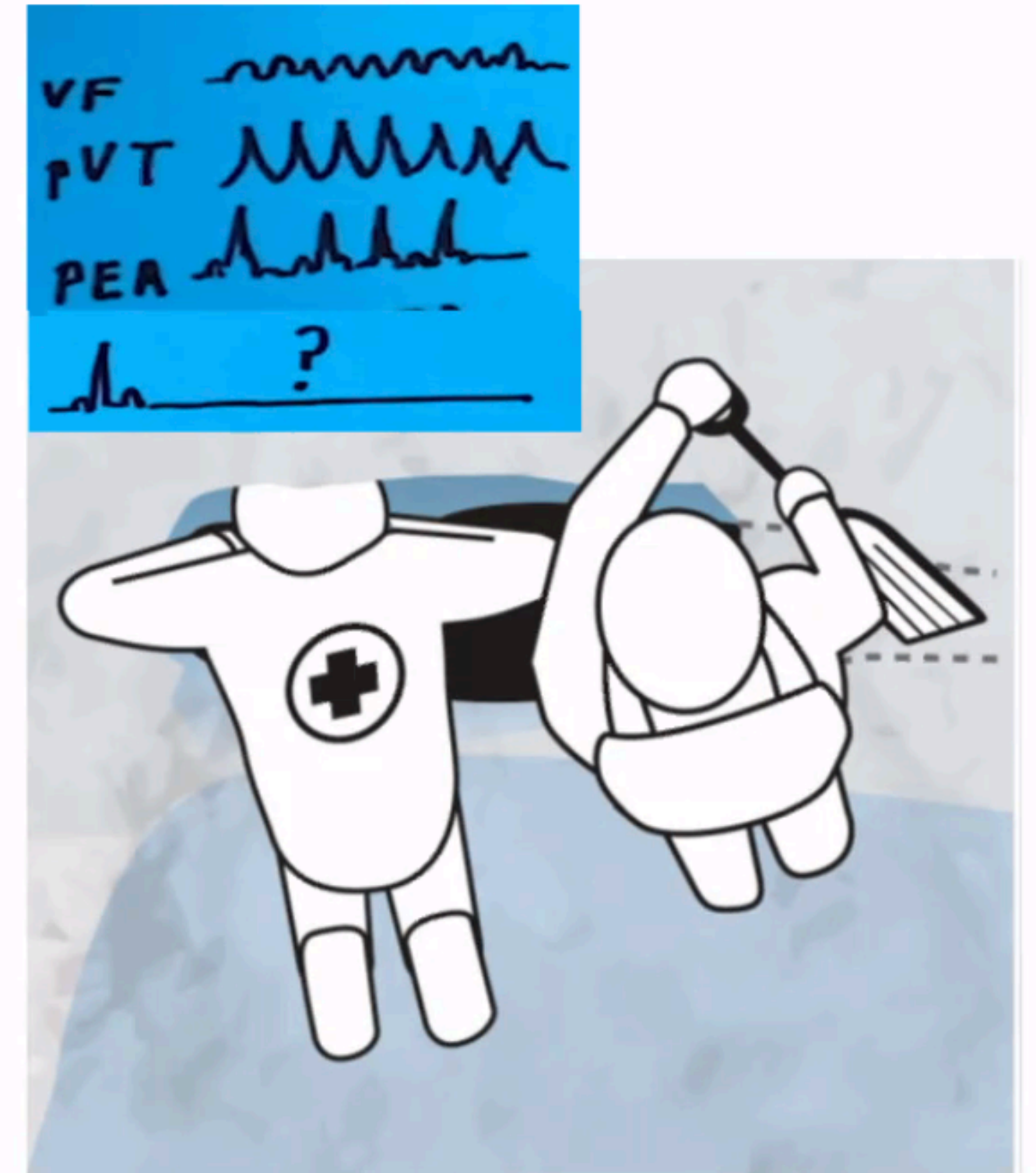
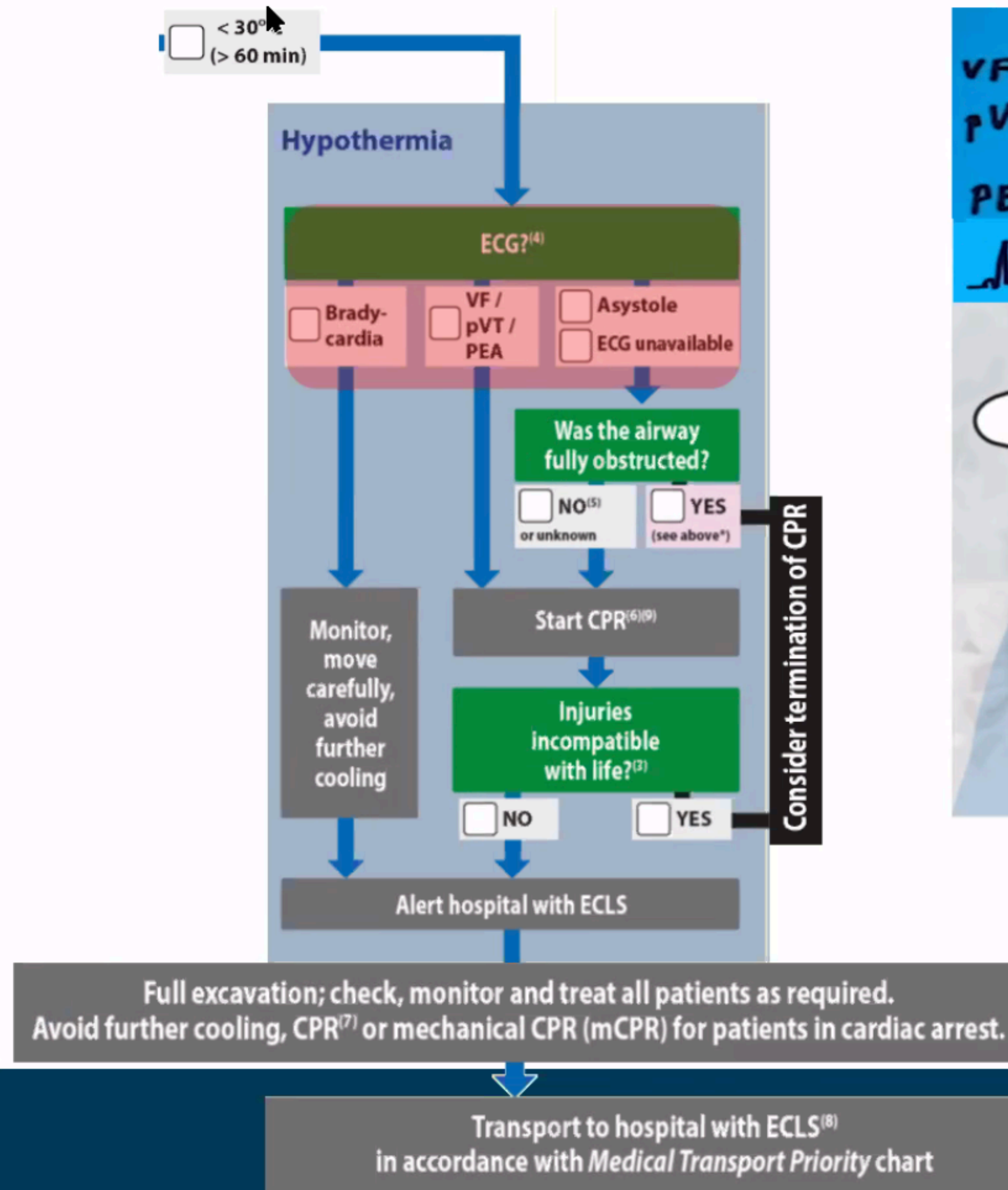
Consider termination of CPR

AvaLife Out Of-Hospital Medical Treatment (Hypothermia)



Full excavation; check and first aid for all patients as required.
Avoid further cooling, CPR⁽⁴⁾ for patients in cardiac arrest.

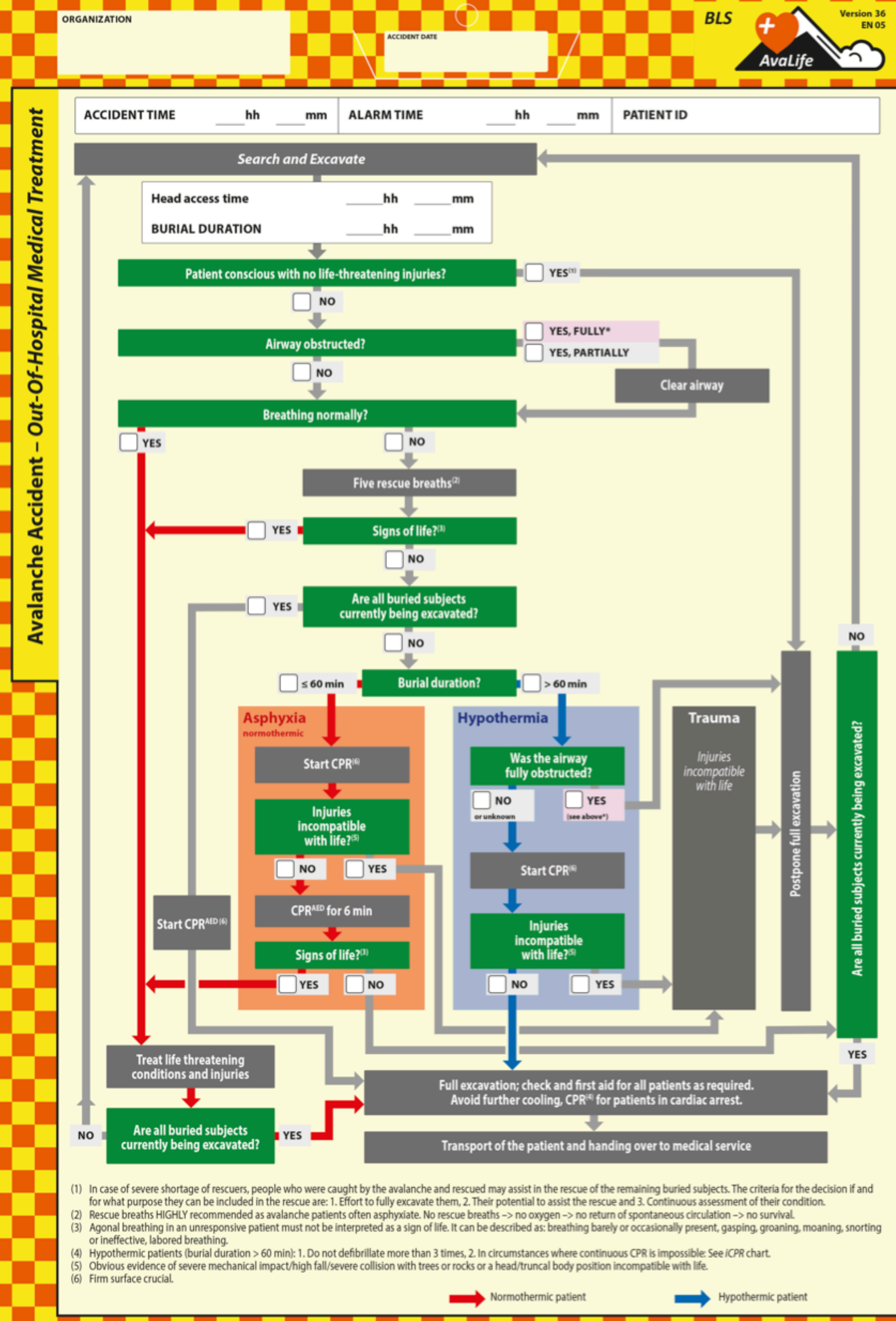
AvaLife Out-Of-Hospital-Medical Treatment (Hypothermia)



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BLS+ ski patrol, guides, ACR

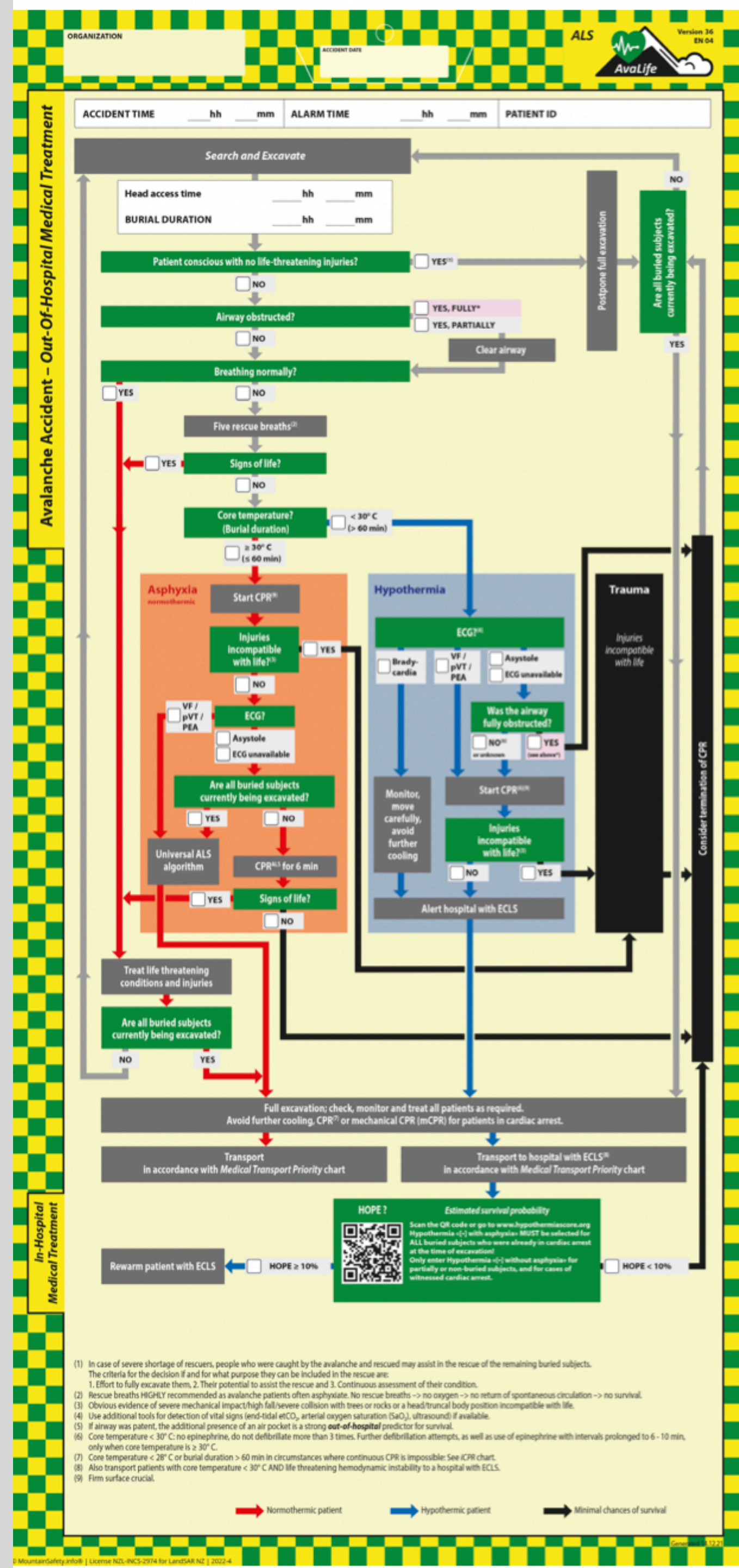
Out of hospital medical treatment



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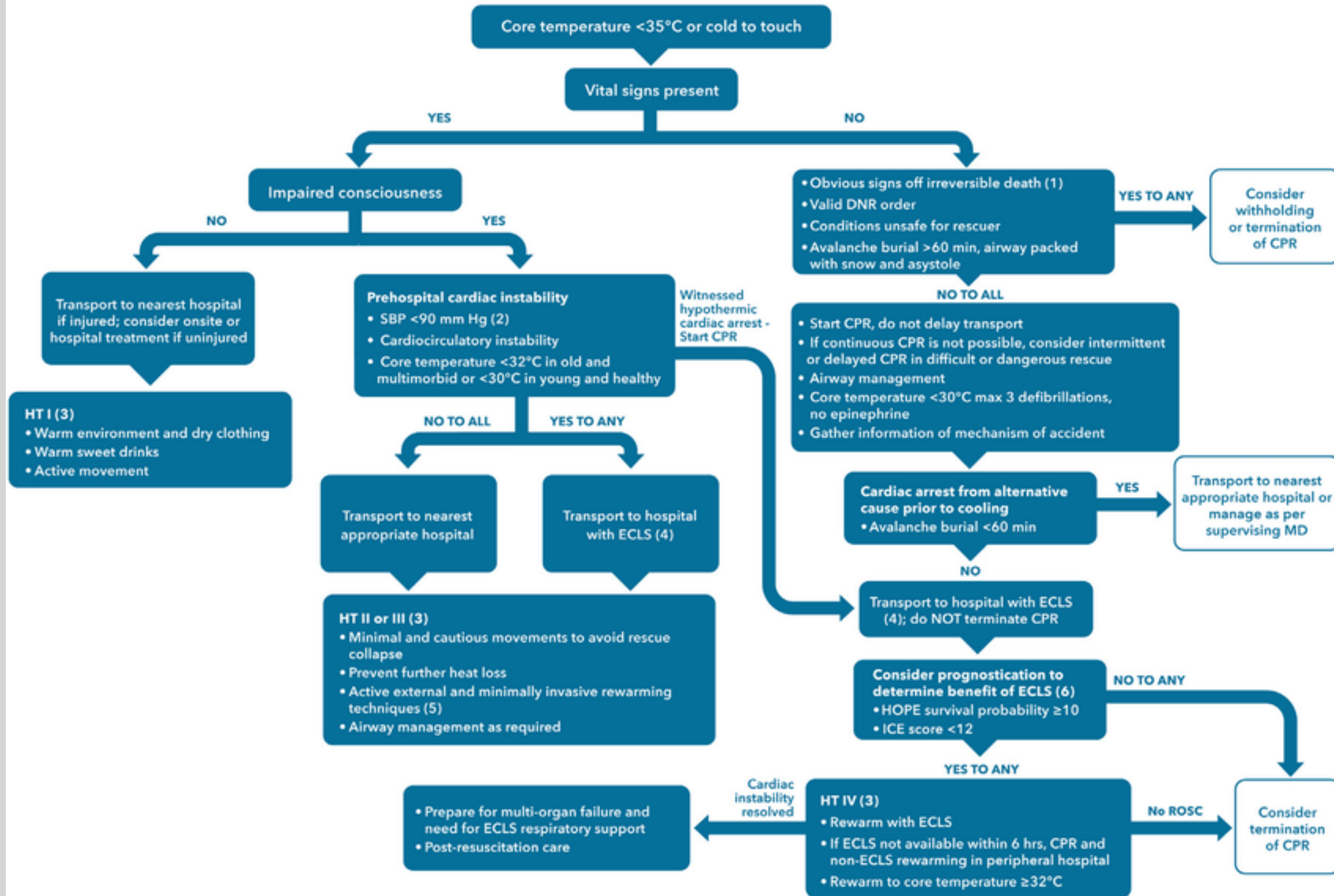
ALS

Out of hospital medical treatment



2021

ACCIDENTAL HYPOTHERMIA



Discussion



"We want to emphasise the importance of creating local multidisciplinary protocols for rare resuscitation situations"

Robert Blasco Mariño

Servicio de Anestesiología y Reanimación,

Hospital Universitario Vall d'Hebron, Barcelona, España