CoSTR - Consensus of Science and Treatment Recommendations

EUROPEAN RESUSCITATION COUNCIL
Avalanche treatment recommendations 2015

Hermann Brugger, Peter Paal
EURAC Institute of Mountain Emergency Medicine Bozen, Italy
Barts Heart Centre, St Bartholomew's Hospital, West Smithfield, London

ICAR Congress 14-18 October 2015 - Killarney, Ireland

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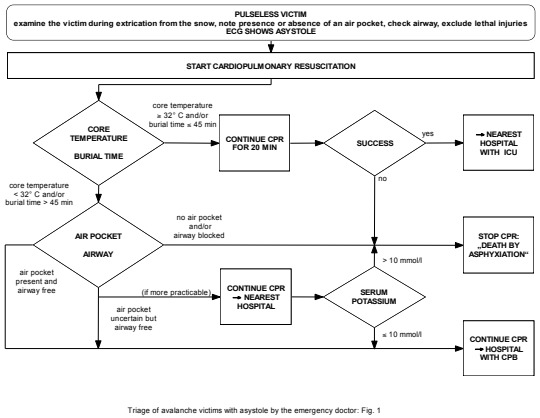
NO CONFLICT OF INTEREST

ICAR Congress 14-18 October 2015 - Killarney, Ireland

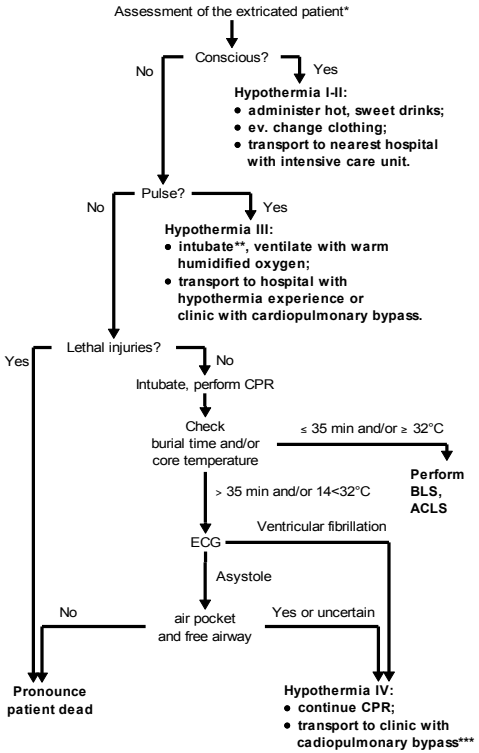
ICAR MEDCOM guidelines 1996-2013

Resuscitation 1996

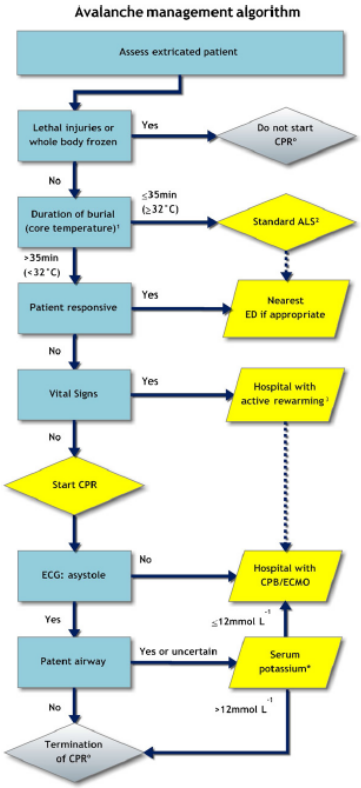


Triage of avalanche victims with asystole by the emergency doctor: Fig. 1

Resuscitation 2001

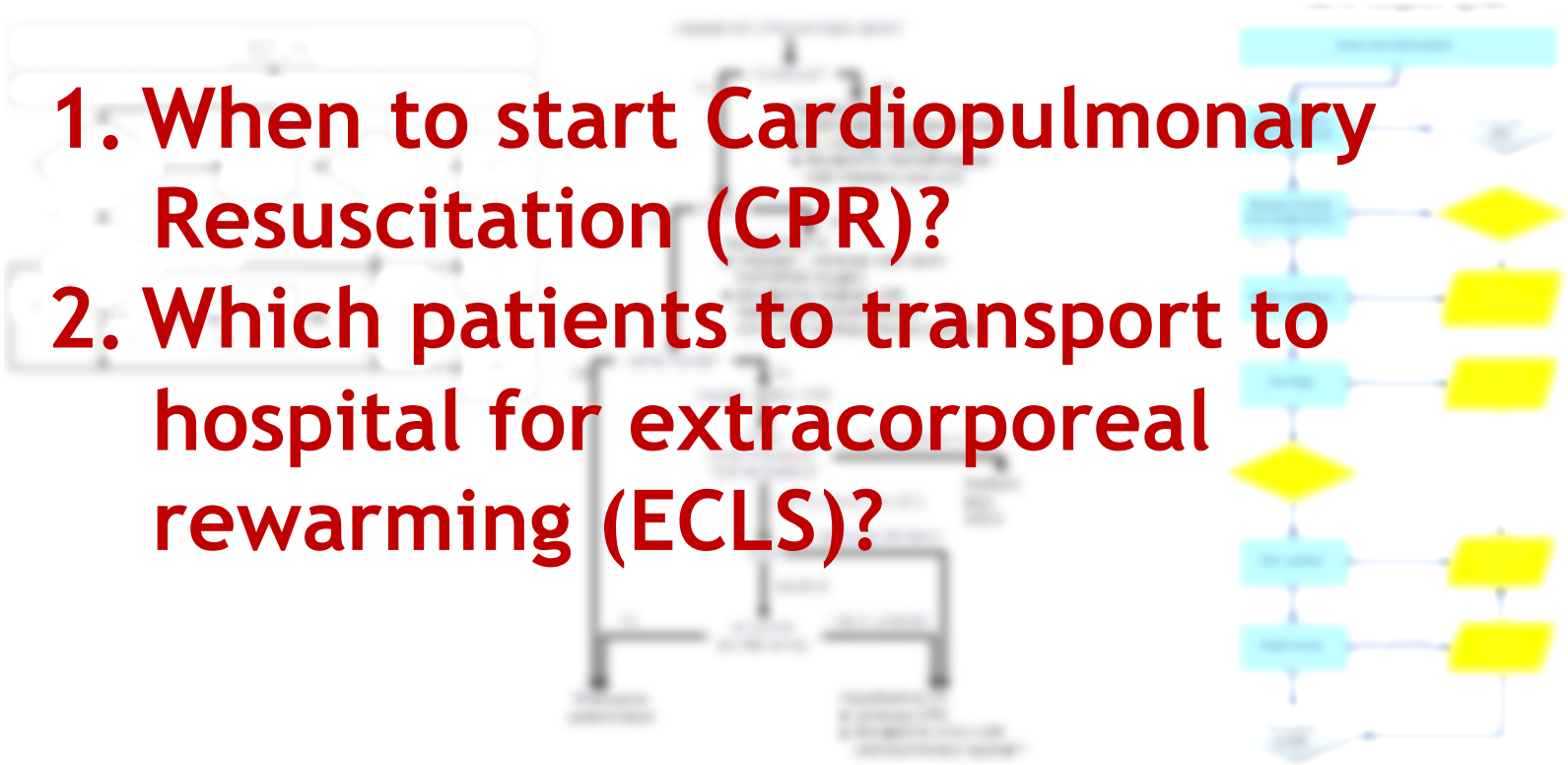


Resuscitation 2013



ICAR MEDCOM guidelines 1996-2013

Resuscitation 1996	Resuscitation 2001	Resuscitation 2013

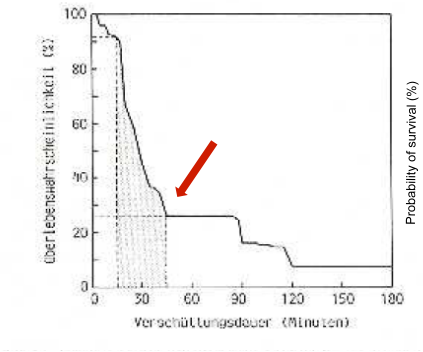
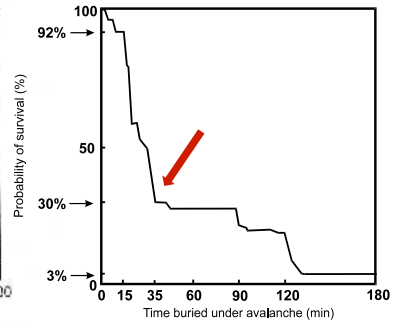
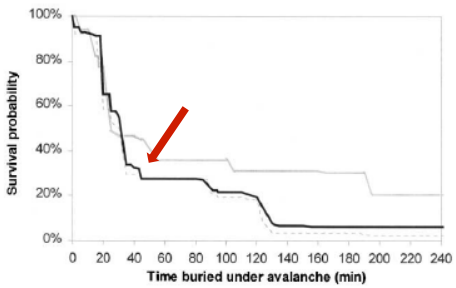


1. When to start Cardiopulmonary Resuscitation (CPR)?
2. Which patients to transport to hospital for extracorporeal rewarming (ECLS)?


PIEPS 457

Cut-offs for CPR+ECLS

A) Duration of burial and airway

Publication	1996	2001	2013
			
	WienKlinWochenschr 1992	Nature 1994	Resuscitation 2001
Burial time Airway	>45min +air pocket	>35min +air pocket	>35min +patent airway

Cut-offs for CPR+ECLS

A) Duration of burial and airway

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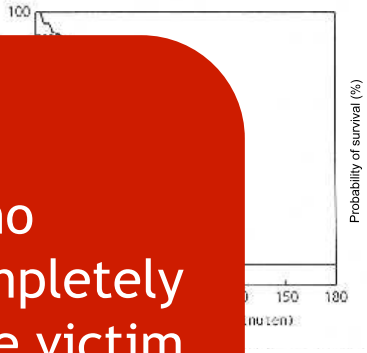
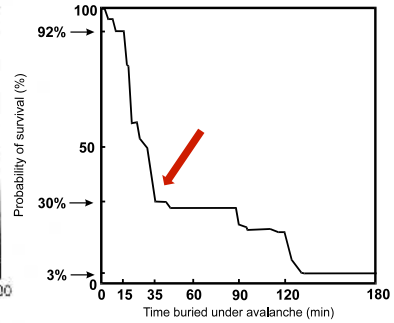
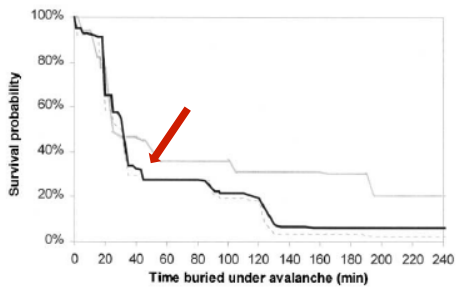
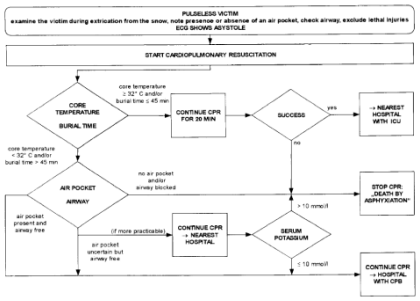
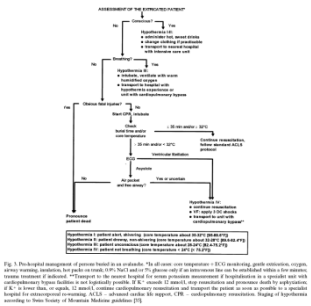
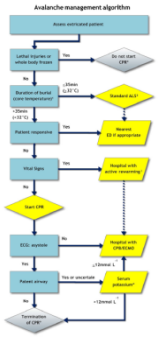
			
	hr 1992	Nature 1994	Resuscitation 2001
	+patent airway	>35min +patent airway	

Beyond 35 min no survival of a completely buried avalanche victim with blocked airway (Resuscitation 2001)

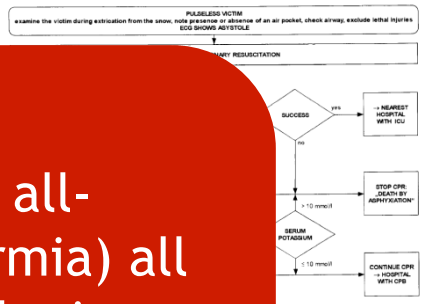
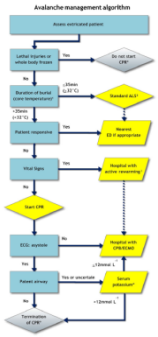
Cut-offs for CPR+ECLS

B) Core temperature

Publication	1996	2001	2013
			
	Resuscitation 1996	Resuscitation 2001	Resuscitation 2013
Core temperature	<32°C	<32°C	<32°C

Cut-offs for CPR+ECLS

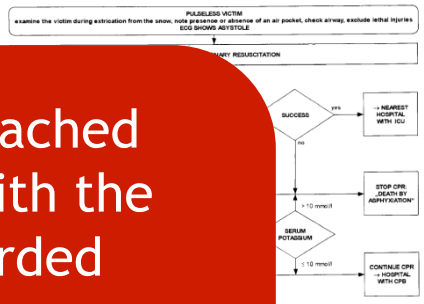
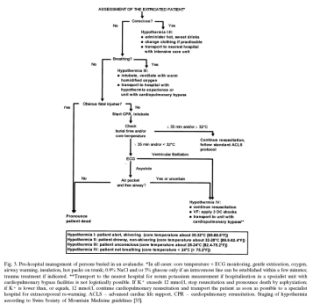
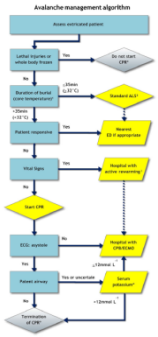
B) Core temperature

Publication	1996	2001	2013
			
	996	Resuscitation 2001	Resuscitation 2013
			<32°C

Below 32°C (in all-cause hypothermia) all types of arrhythmias are encountered, including ventricular fibrillation (Danzl 2001)

Cut-offs for CPR+ECLS

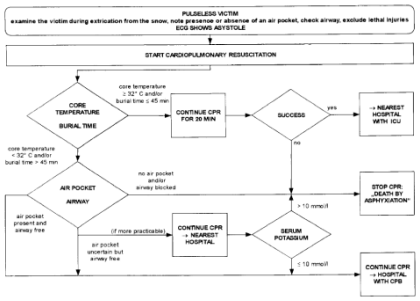
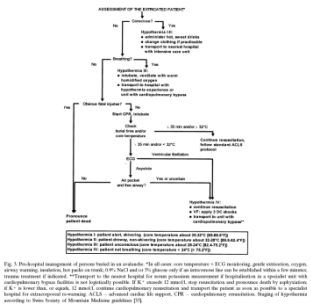
B) Core temperature

Publication	1996	2001	2013
			
	996	Resuscitation 2001	Resuscitation 2013
			<32°C

32°C can be reached after 35 min with the maximum recorded drop in core temperature during snow burial 9°C/hour (Oberhammer et al. 2008)

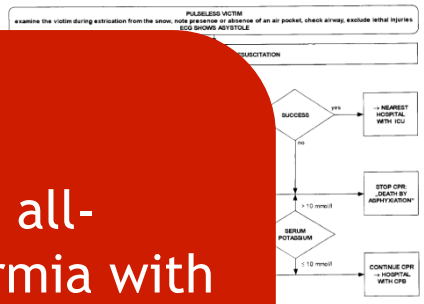
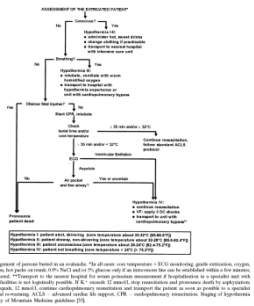
Cut-offs for CPR+ECLS

C) Serum potassium

Publication	1996	2001	2013
			
	Resuscitation 1996	Resuscitation 2001	Resuscitation 2013
Serum potassium	<10mmol/L	≤12mmol/L	≤8-12mmol/L

Cut-offs for CPR+ECLS

C) Serum potassium

Publication	1996	2001	2013
			
	996	Resuscitation 2001	Resuscitation 2013
	≤12mmol/L		≤8-12mmol/L

One survivor in all-cause hypothermia with 11.8mmol/L
(Dobson 1996, Boyd 2010)

Recent outcome studies of avalanche victims with cardiac arrest + ECLS

- **Austria** (1996-2013, n=170)
  1.2% survival*
- **Norway** (1985-2013, n=8)
  0% survival**

*Mair et al. 2014,, **Hilmo et al. 2014

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- **France** (1994-2013, n=48)
  16.6% survival***

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Selected population:
hospital admissions only

*Mair et al. 2014,, **Hilmo et al. 2014, ***Bouè et al. 2014

Recent outcome studies of avalanche victims with cardiac arrest + ECLS

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- **Norway** (1985-2013, n=8)
  0% survival**
- **France** (1994-2013, n=4[illegible])
  16.6% survival***

Survival rate of avalanche victims with cardiac arrest and ECLS is low

*Mair et al. 2014,, **Hilmo et al. 2014, ***Bouè et al. 2014

ERC guidelines 2015

- **84 arrested avalanche victims** over 16 years [Mair 1987-2013 = **1.75 cases/y**]*, 28 years [Hilmo 2014, 1985-2013 = **0.2 cases/y**]**, 18 years [Bouè 1994-2013 = **2.7 cases/y**]***
- **All survivors in these studies had witnessed cardiac arrest**
- **1 unwitnessed asystolic long term survivor in literature******

*Mair et al. 2014,, **Hilmo et al. 2014, ***Bouè et al. 2014, ****Althaus 1982

ERC guidelines 2015

- Too many asphyxiated patients transported to ECLS
- Futile ECLS treatments need to be reduced without risk of undertreating

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Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

European Resuscitation Council Guidelines for Resuscitation 2015 Section 4. Cardiac arrest in special circumstances

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[c] Cardiac Anaesthesia and Cardiac Intensive Care, NIHR Southampton Respiratory Biomedical Research Unit, Southampton University Hospital NHS Trust, Southampton, UK
[d] Anaesthesia and Intensive Care Medicine, Southmead Hospital, North Bristol NHS Trust, Bristol, UK
[e] Emergency and Disaster Medicine, Six October University Hospital, Cairo, Egypt
[f] Departments of Renal and Internal Medicine, Victoria Hospital, Kirkcaldy, Fife, UK
[g] Society to Rescue People from Drowning, Amsterdam, The Netherlands
[h] Bergen Emergency Medical Services, Department of Anaesthesia and Intensive Care, Haukeland University Hospital, Bergen, Norway
[i] EURAC Institute of Mountain Emergency Medicine, Bozen, Italy
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[k] Center for Emergency Medicine, Clinical Hospital Center Zagreb, Zagreb, Croatia
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[w] School of Clinical Sciences, University of Bristol, UK

http://www.cprguidelines.eu/

ERC guidelines 2015

A) Duration of burial and core temperature

- No successful ECLS from >30°C recorded in literature

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➢ Reduce core temperature from 32°C to 30°C

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A) Duration of burial and core temperature

- No successful ECLS from >30°C recorded in literature

➢ **Reduce core temperature from 32°C to 30°C**

➢ **Increase duration of burial to 60 minutes**
(30°C can be reached with the maximum recorded drop in core temperature during snow burial of 9°C/hour*)

*Oberhammer et al. 2008

ERC guidelines 2015

A) Duration of burial and core temperature

- No successful ECLS from >30°C recorded in literature

➢ **Reduce core temperatu**

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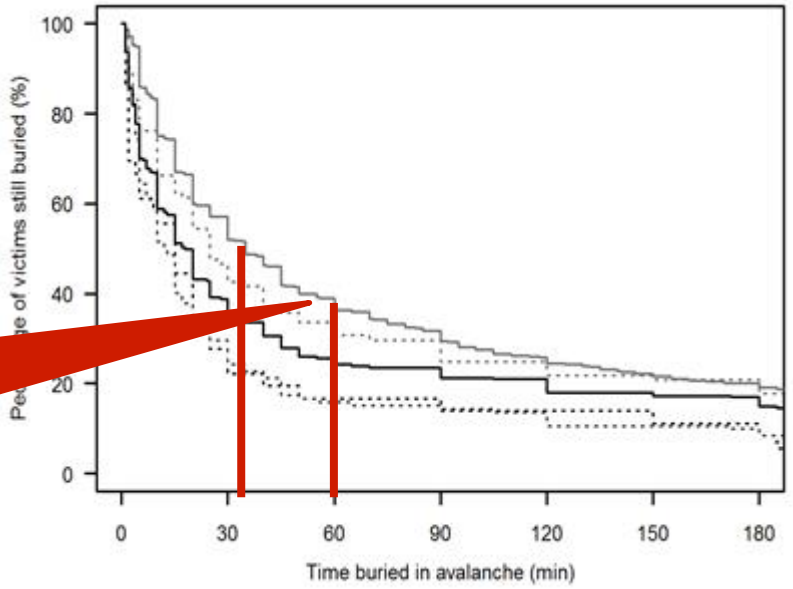
Changes will lower futile hospital admissions by 20%



*Oberhammer et al. 2008

ERC guidelines 2015

B) Serum potassium

- **No avalanche survivor in literature >6.4 mmol/L***

*Locher and Walpoth, 1996

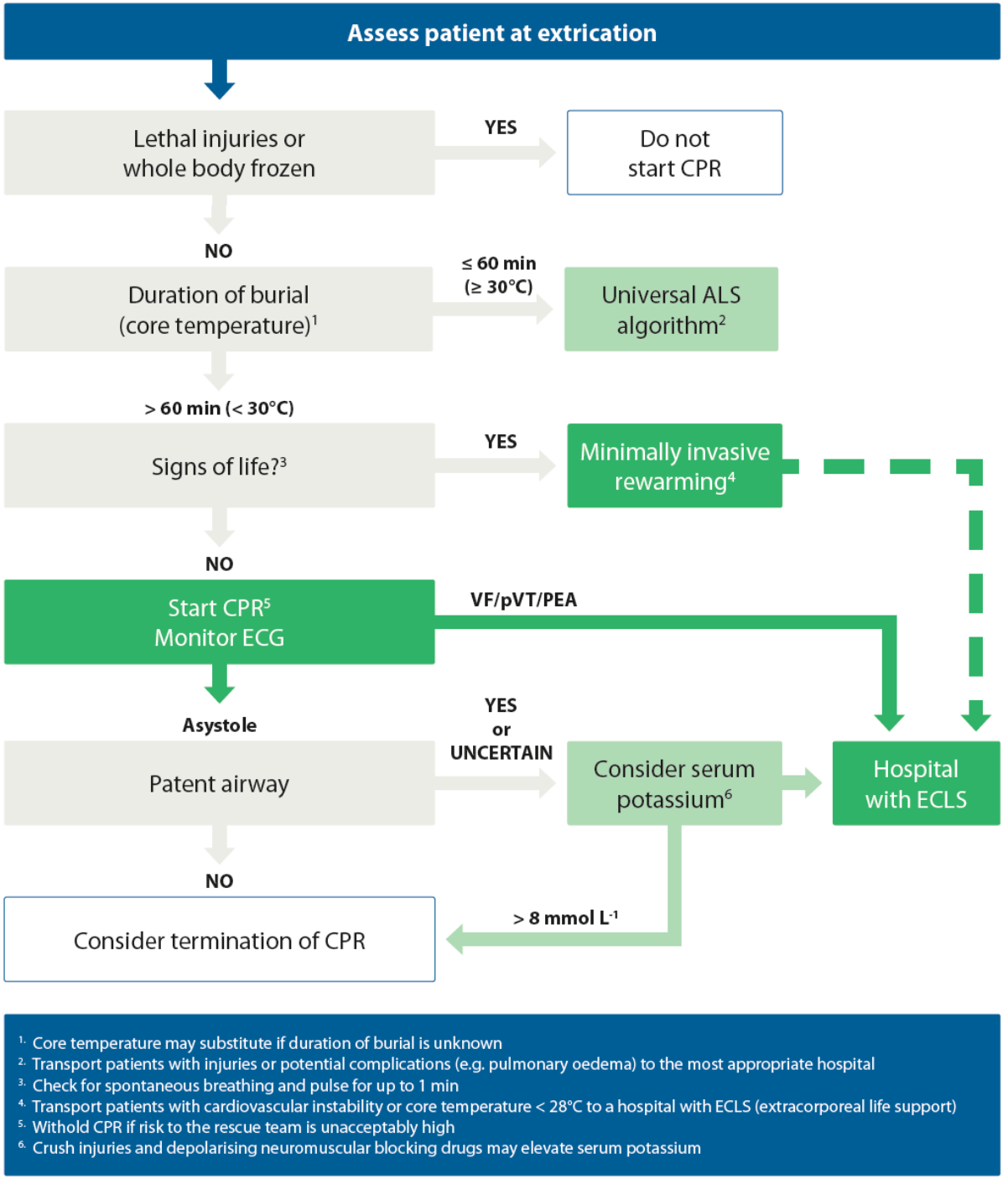
ERC guidelines 2015

B) Serum potassium

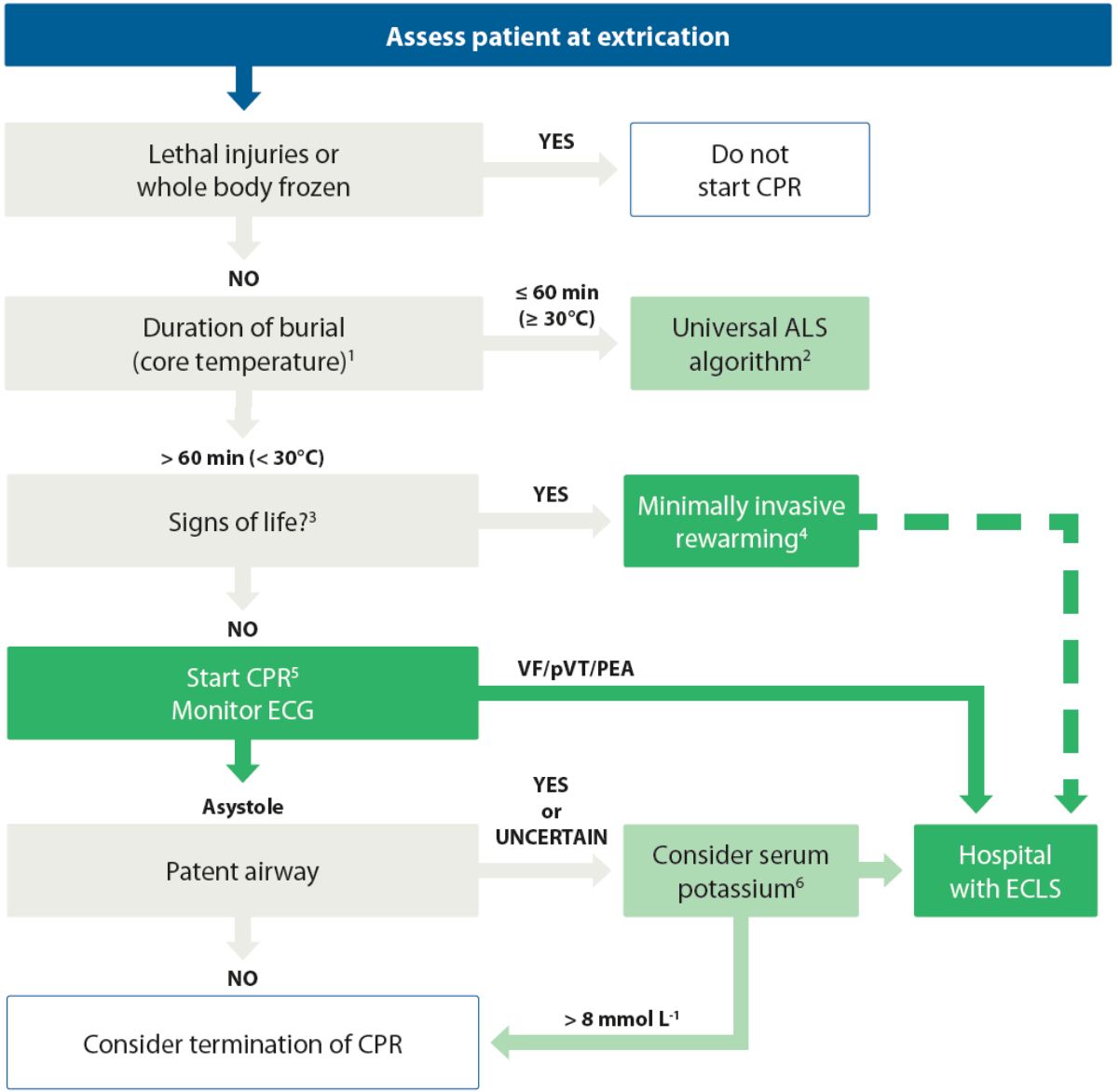
- No avalanche survivor in literature >6.4 mmol/L*

➢ Reduce cut-off level K+ from 12 to 8 mmol/L

*Locher and Walpoth, 1996



1. Core temperature may substitute if duration of burial is unknown
2. Transport patients with injuries or potential complications (e.g. pulmonary oedema) to the most appropriate hospital
3. Check for spontaneous breathing and pulse for up to 1 min
4. Transport patients with cardiovascular instability or core temperature < 28°C to a hospital with ECLS (extracorporeal life support)
5. Withold CPR if risk to the rescue team is unacceptably high
6. Crush injuries and depolarising neuromuscular blocking drugs may elevate serum potassium



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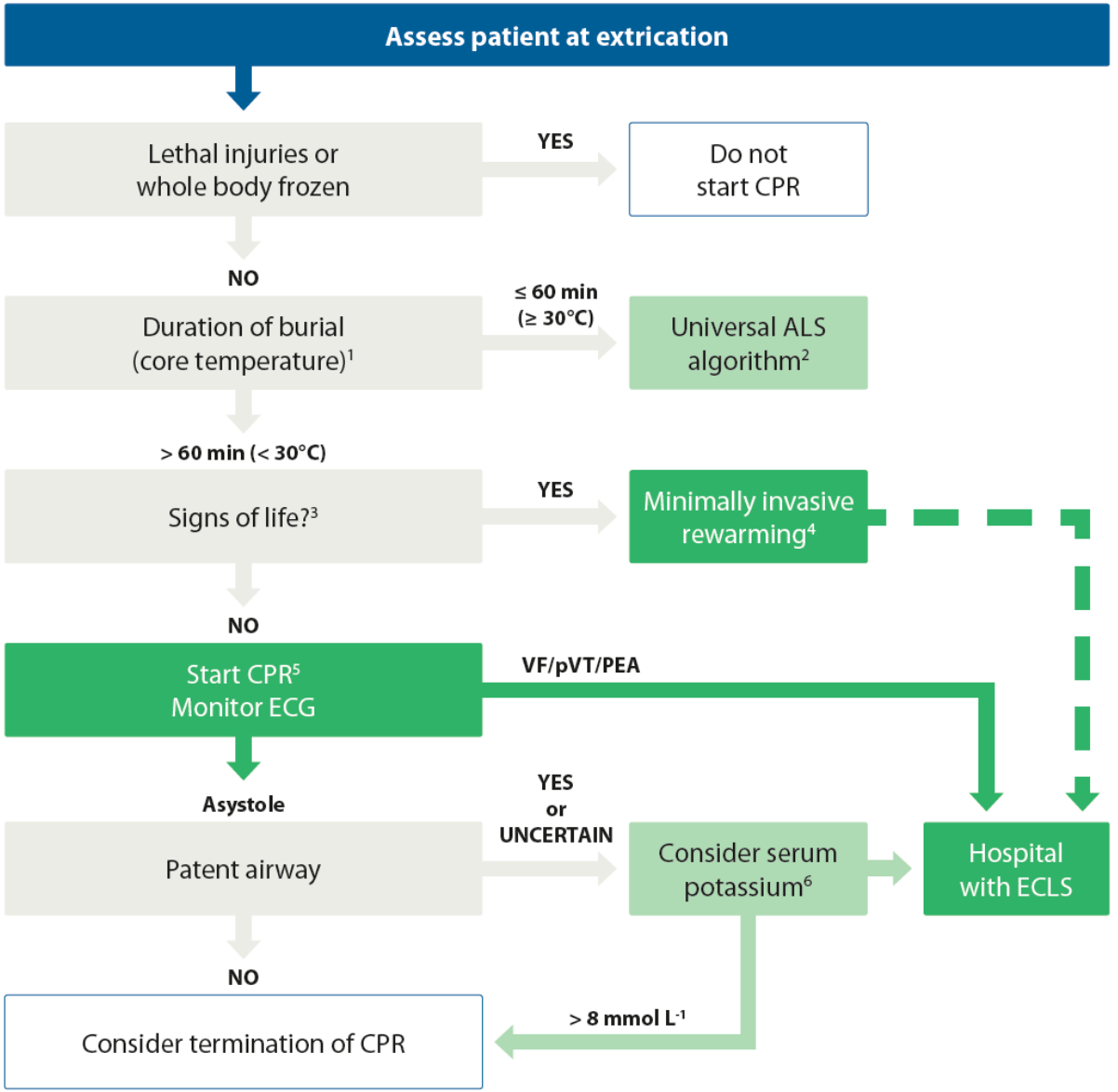

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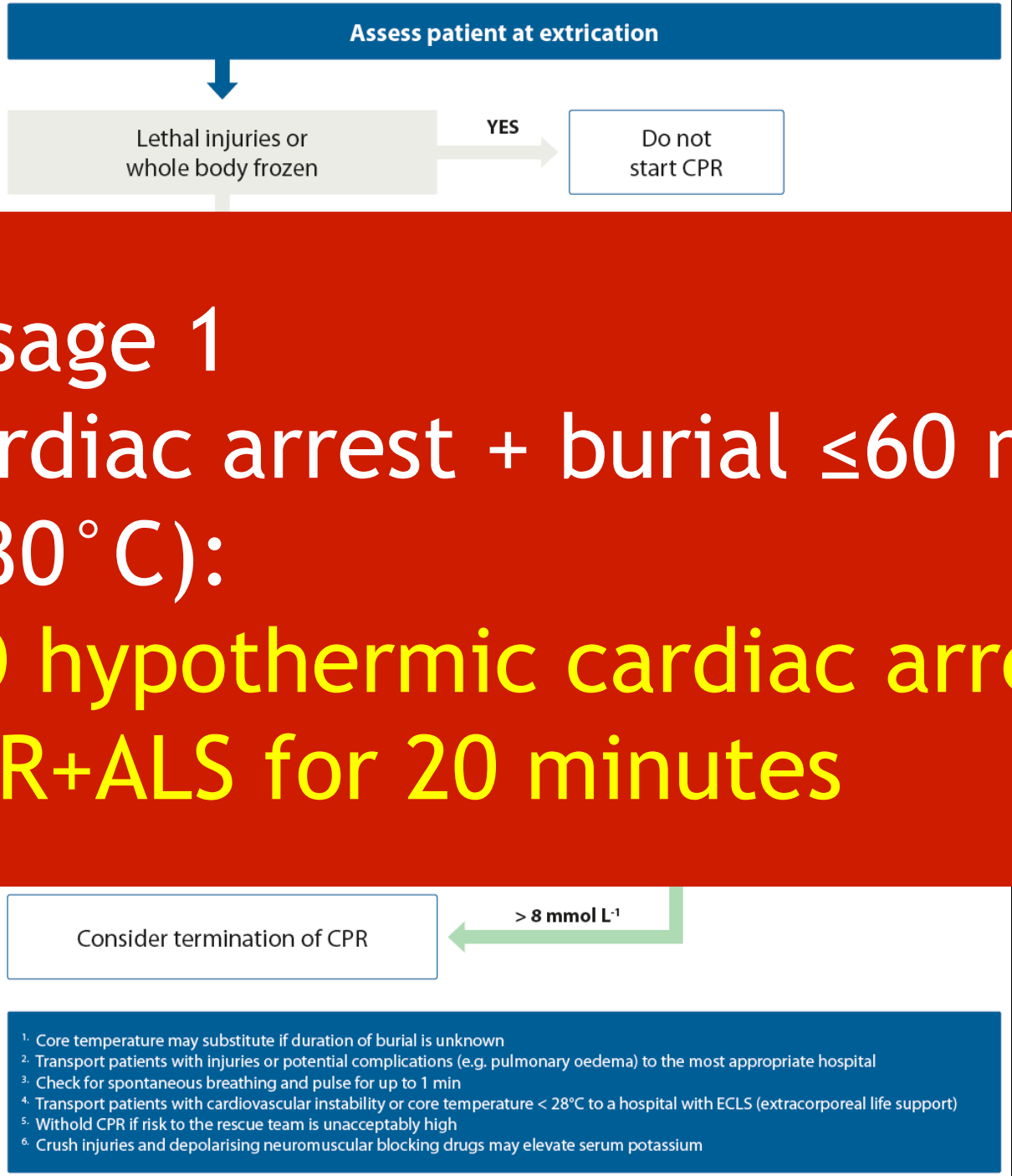
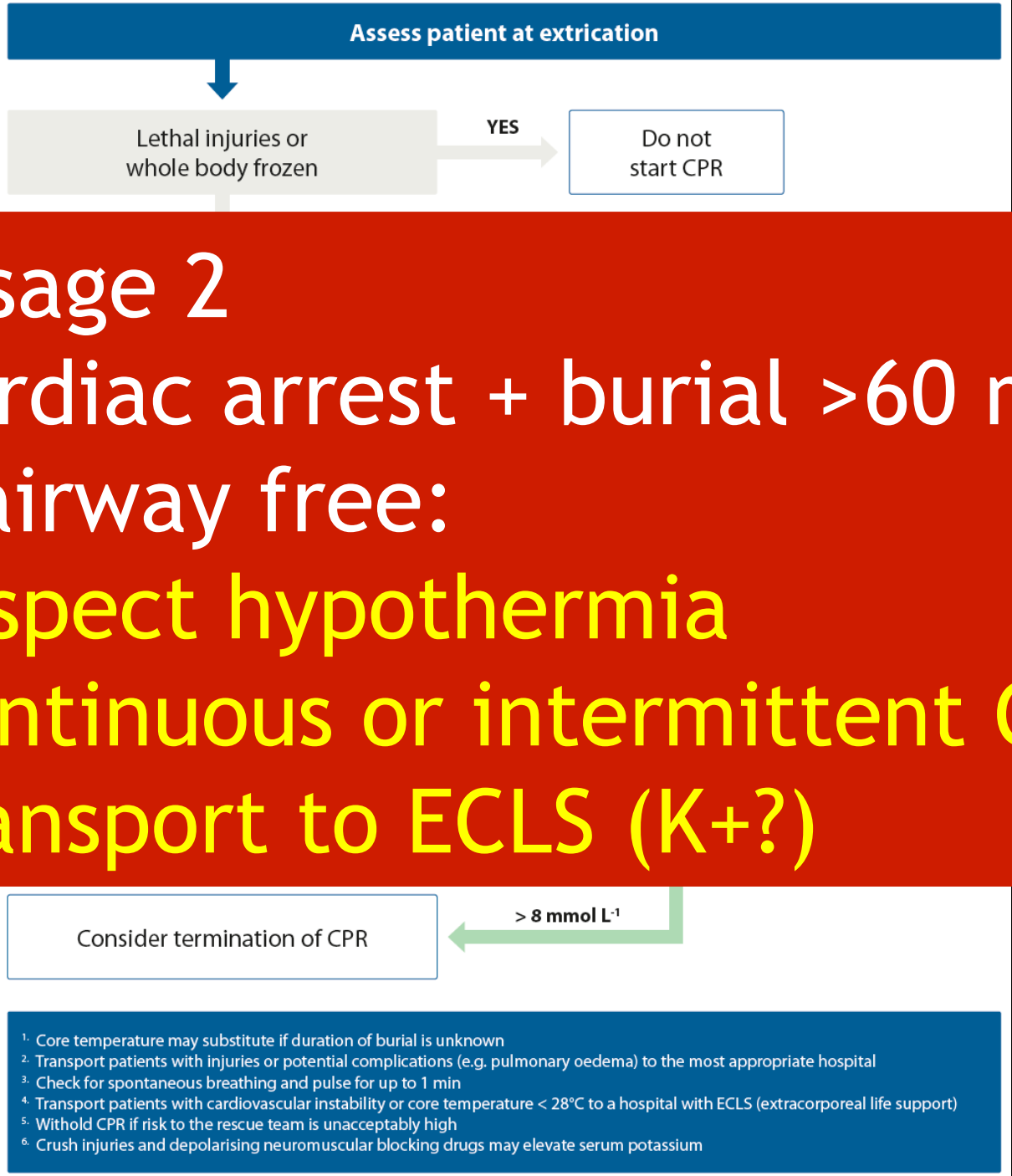


Message 1

- Cardiac arrest + burial ≤60 min (≥30°C):
  NO hypothermic cardiac arrest
  CPR+ALS for 20 minutes



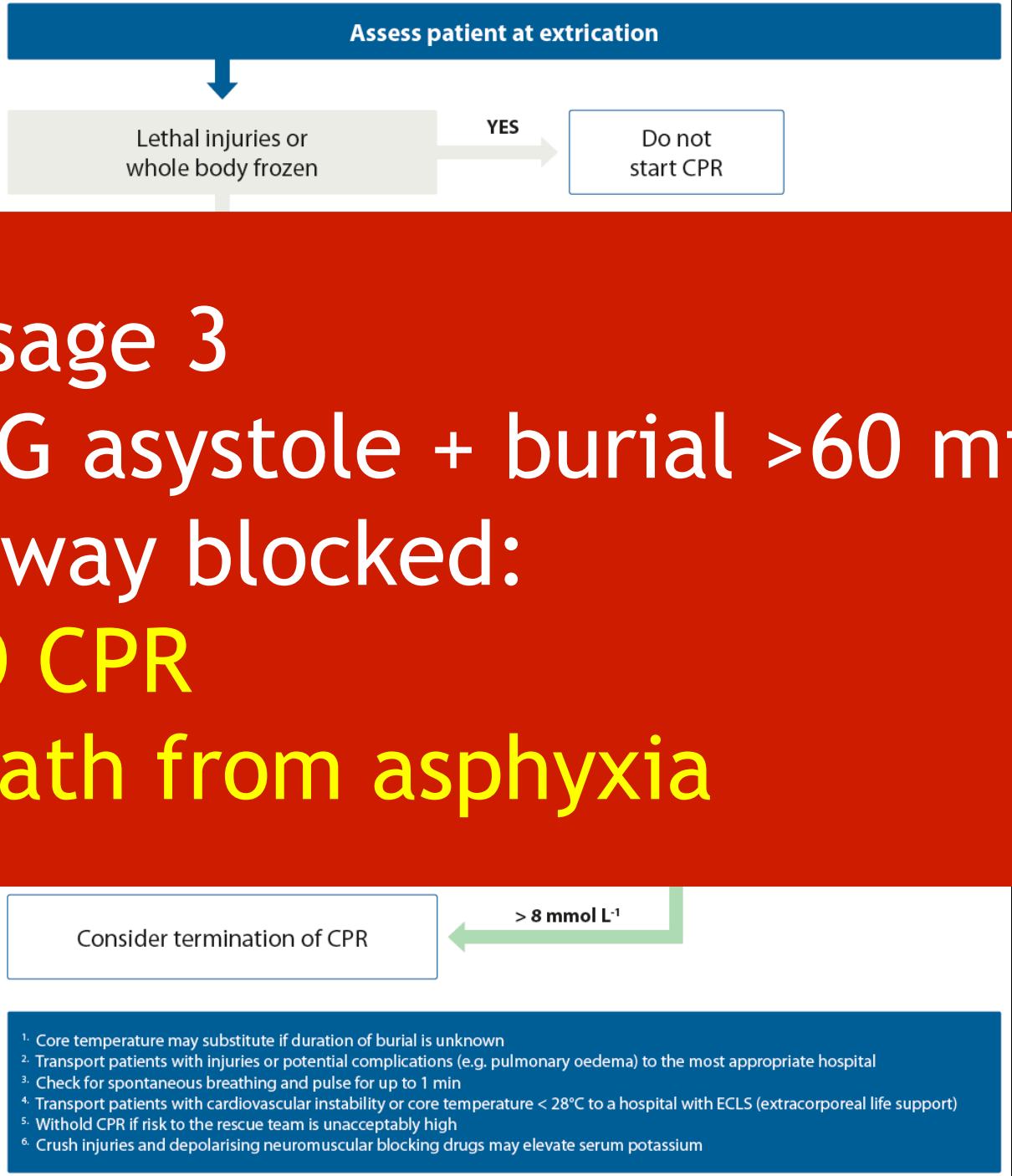
Message 2

- Cardiac arrest + burial >60 min + airway free:

  Suspect hypothermia

  Continuous or intermittent CPR

  Transport to ECLS (K+?)



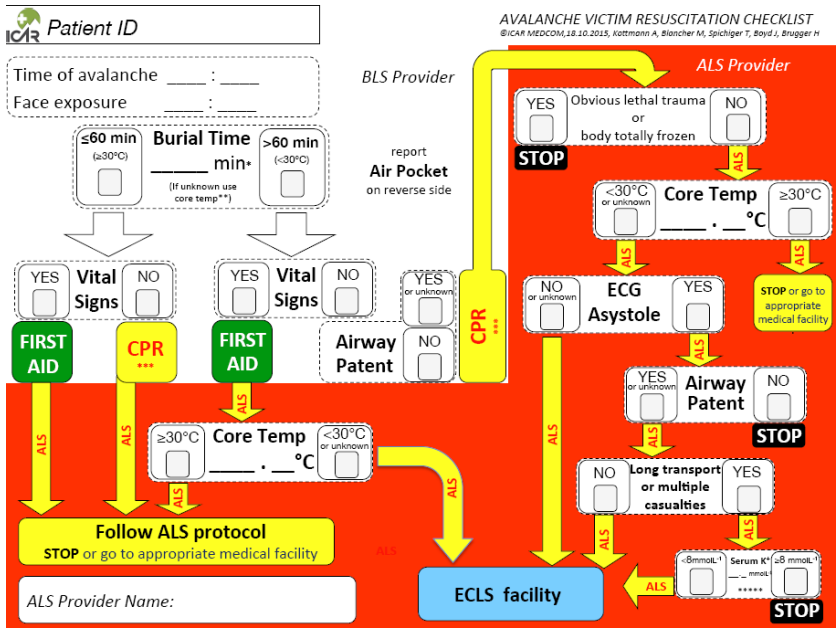
Message 3

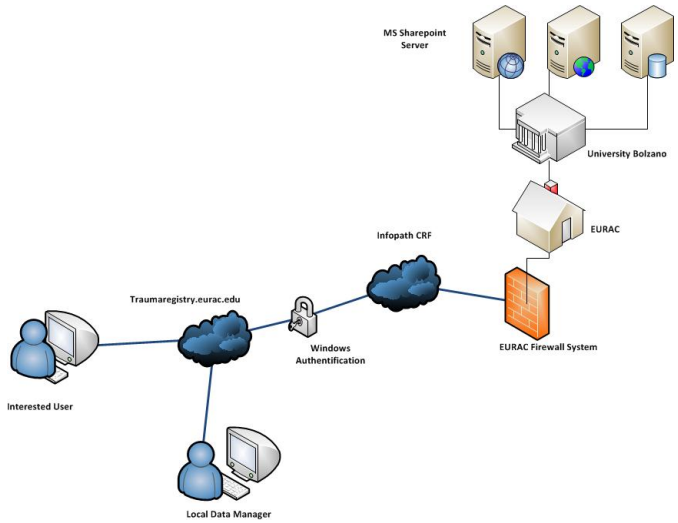
- ECG asystole + burial >60 min + airway blocked:
  NO CPR
  Death from asphyxia

Uniform avalanche data recording!

- Use avalanche resuscitation checklists

- International avalanche registry





EURAC research

Institute of
Mountain Emergency Medicine

Work in progress