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## Introduction

- Hypothermic cardiac arrest (CA) usually appears with a core temperature below 30°C. Extracorporeal life support rewarming (ECLSR) by using ECMO is the treatment of choice with good neurological outcome.
- Historically, the indication for ECLSR was based on serum K<sup>+</sup> with a maximum threshold set at 12mmol/l.
- The HOPE score, with a suggested cut-off at 10%, has recently been proposed to guide rewarming decisions for hypothermic CA (European Resuscitation Council 2021). **HOPE < 10% = no ECLSR.**
- Aim : Study hypothermic CAs who **did not receive ECLSR** but were admitted to a hospital equipped for it.

## Materials & Methods

- Swiss multicentric (Lausanne, Sion, Geneva) retrospective observational study, from January 2000 to May 2021.
- Group analysis according to serum potassium at hospital admission : K<sup>+</sup> < 12mmol/L and K<sup>+</sup> ≥ 12mmol/L.
- Primary outcome : Were all decisions compliant with guidelines at the time of admission (based on K<sup>+</sup>) ?
- Secondary outcomes : Decisional criteria leading to resuscitation termination, retrospective HOPE calculation.

## Results (1)

- We included 38 patients (74% male) among the 97 identified hypothermic CAs, 14 of whom were avalanche victims.
- The mean temperature was 25 ± 6.2°C.
- **33% of non-rewarming decisions were compliant with previous guidelines (K<sup>+</sup> ≥ 12mmol/L), meaning that 67% of patients had a K<sup>+</sup> value at hospital admission in favour of ECLSR but were not rewarmed (†).**

- **Why did they not receive ECLSR? →**

Criteria leading to the decision of non-rewarming <sup>a</sup>	n
Variables included in the HOPE estimation of survival probabilities	
Core temperature insufficiently low to cause CA by pure hypothermia (temperature values in °C: 29.6, 30.1, 31, 31.4)	4
Potassium measurement at hospital admission (measurements in mmol/L: 6.8, 10.1, 10.2)	3
Long duration of CPR (in minutes: 55, 68, 158)	3
Old age (83)	1
Drowning assumed to be a more likely cause of CA than hypothermia based on circumstances	1
Variables not included in the HOPE estimation of survival probabilities	
Overall biological parameters of arterial blood-gas measurements (lactate concentration, pH, potassium)	7
Duration of no-flow <sup>b</sup> (in minutes: 15, 20, 30, unknown n = 2)	5
Asystole as CA rhythm	4
Overall prognosis and comorbidities	3
Do not resuscitate order or presumed wishes stated by relatives	3
Other cause of CA more likely than hypothermia based on circumstances (heart disease, head trauma)	3
Duration of burial for avalanche victims (short burial, i.e. <35 min, durations in minutes unknown)	2
Undetermined <sup>c</sup>	4

<sup>a</sup> Multiple decisional criteria described in the table may apply to the same patient.

<sup>b</sup> No-flow is the time during which cardiac output is absent, before any CPR is performed

<sup>c</sup> No criteria for non-rewarming were identified in the patient's medical records for these cases.

**Table 1.** Criteria mentioned in the medical charts leading to resuscitation termination for 67% (n=24) of patients, whose K<sup>+</sup> at admission did not contraindicate ECLSR

Potassium	> 12 mmol/L	≤ 12 mmol/L	
n =	10	24	
	ECLSR not indicated	ECLSR indicated	
		Futile ECLSR	
n =	10	13	11
HOPE		< 10%	≥ 10%

**Figure 1.** Distribution of ECLSR eligibility and comparison of triage tools : K<sup>+</sup> alone vs HOPE

## Results (2)

- **All patients with K<sup>+</sup> ≥ 12mmol/L had a HOPE score < 10%, meaning no ECLSR either.**
- **54% (13/24) of patients with K<sup>+</sup> < 12mmol/L, (indicating ECLSR) had a HOPE score < 10%.**
- The retrospective HOPE score calculation, when used with a 10% threshold, would have supported 68% (23/34) of all decisions made by the clinicians not to rewarm patients.

## Discussion

- The level of evidence underlying the use of the potassium level alone is low. **The HOPE score improves triage by limiting the number of patients with futile rewarming compared with K<sup>+</sup> levels alone.**
- Most of the criteria listed for resuscitation termination are no longer considered as exclusion factors for ECLSR (asystole, age, long duration of no-flow).
- By extrapolating to our population the positive predictive values (proportion of patients who survived after ECLSR among those with HOPE ≥ 10%) of 55% and 57%, respectively from the HOPE derivation and validation studies, we concluded that 6 of the 11 patients with HOPE ≥ 10% could have benefited from ECLSR with potential survival.

**Conclusion :** The adherence to hypothermic CA resuscitation guidelines at the time of admission was low. However, the majority of non-rewarming decisions would still have been supported by the HOPE score calculation.

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