Hypotermi, oppvarming og ECMO

LIS Undervisning

06.09.2021 & 13.09.2021

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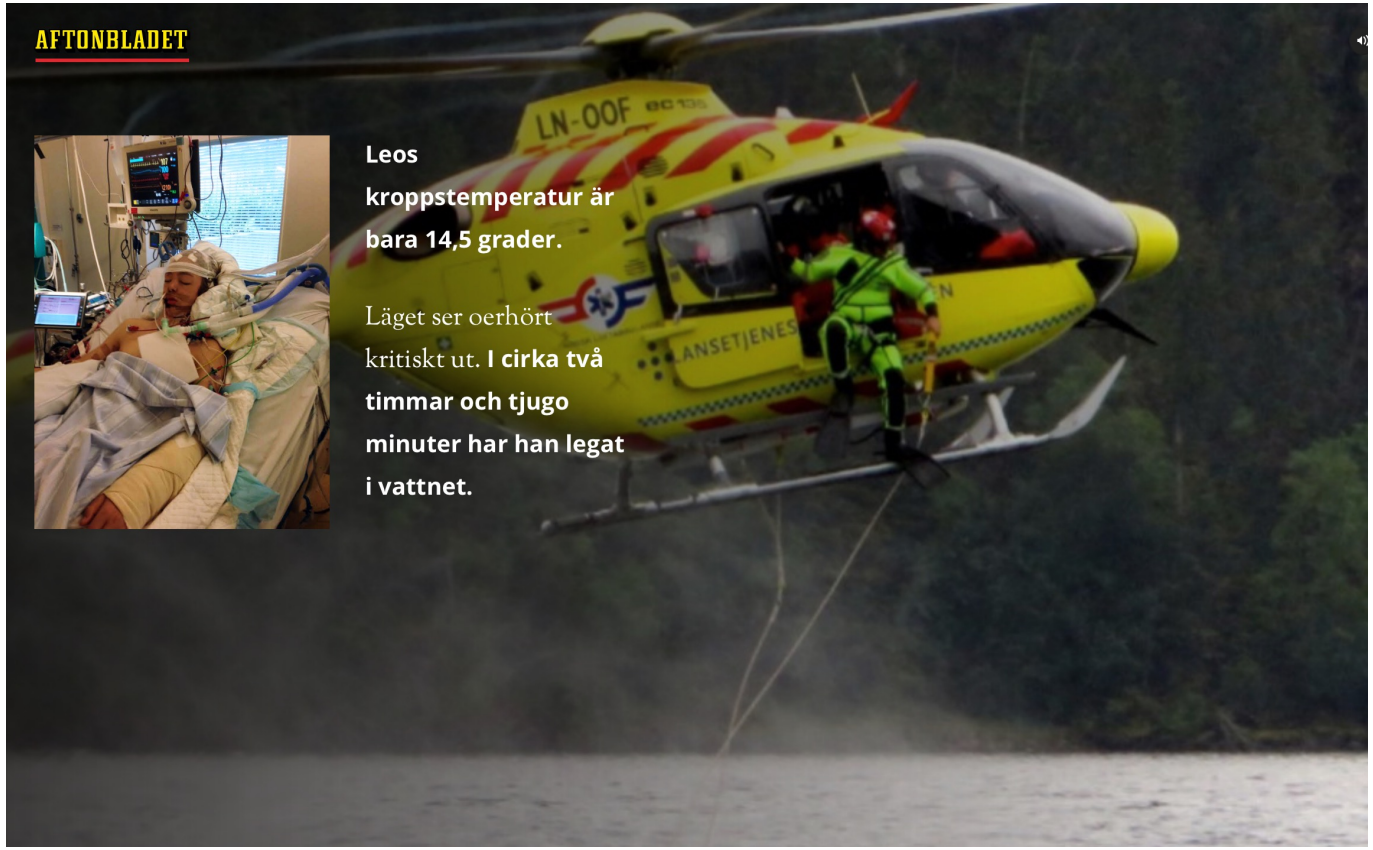
ETT ÅR ETTER: Far Jan Ove Lysberg, Caroline Husvik Lysberg og mor Tone Husvik Lysberg i Carolines nye hjem i Namsos. Foto:Marius L… Les hele

Caroline overlevde 50 minutter under vann

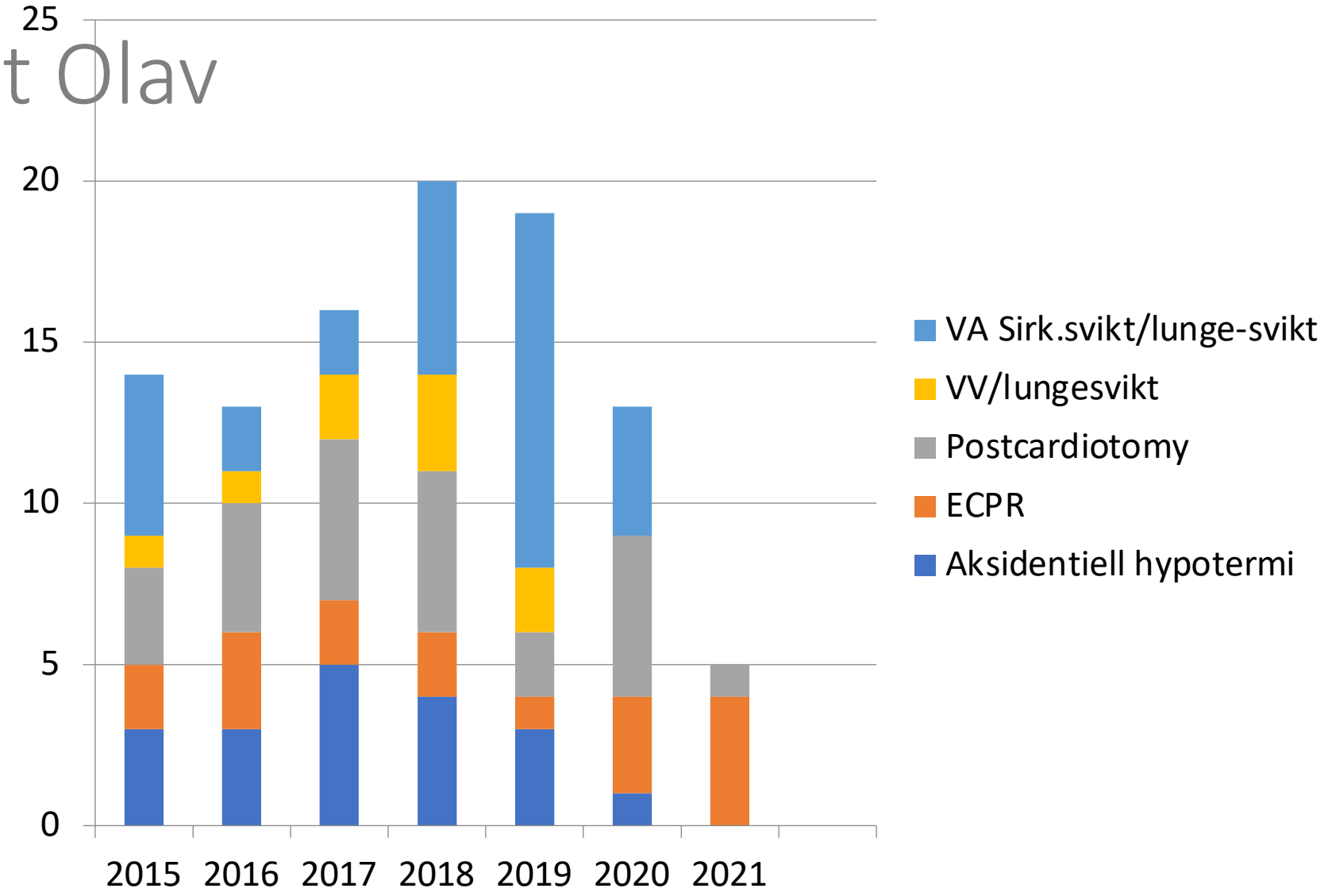
Hun lå 50 minutter under vann, før redningsdykkerne hentet henne opp. Nå forteller Caroline Husvik Lysberg sin historie.

- Vi fikk tilbake vår sønn

Gabriel Matsson (15) var nedkjølt til 18 grader da han kom til St. Olavs hospital etter en dramatisk kanoulykke for tre år siden. Da reddet legene livet hans.


AFTONBLADET
LN-OOF
Leos kroppstemperatur är bara 14,5 grader.
Läget ser oerhört kritiskt ut. I cirka två timmar och tjugo minuter har han legat i vattnet.

ECMO St Olav


25
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2015
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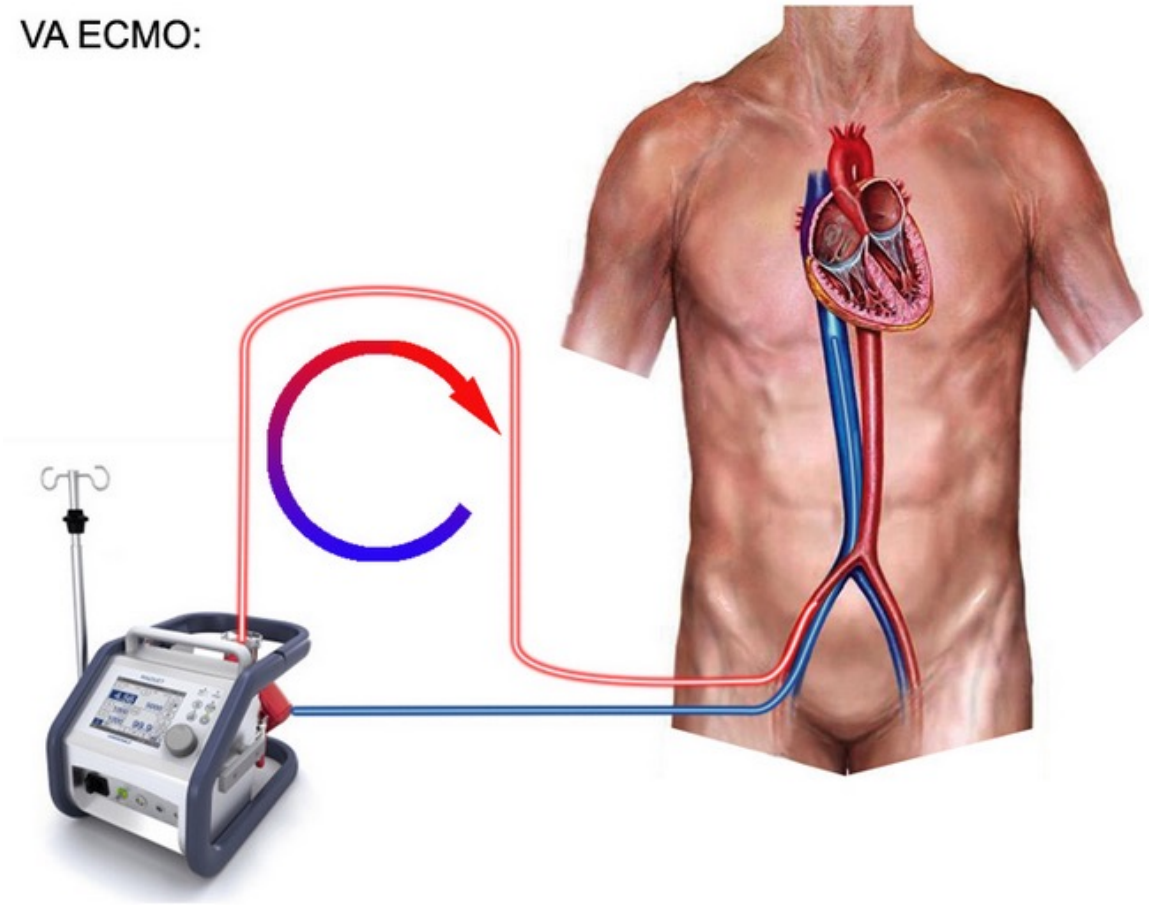
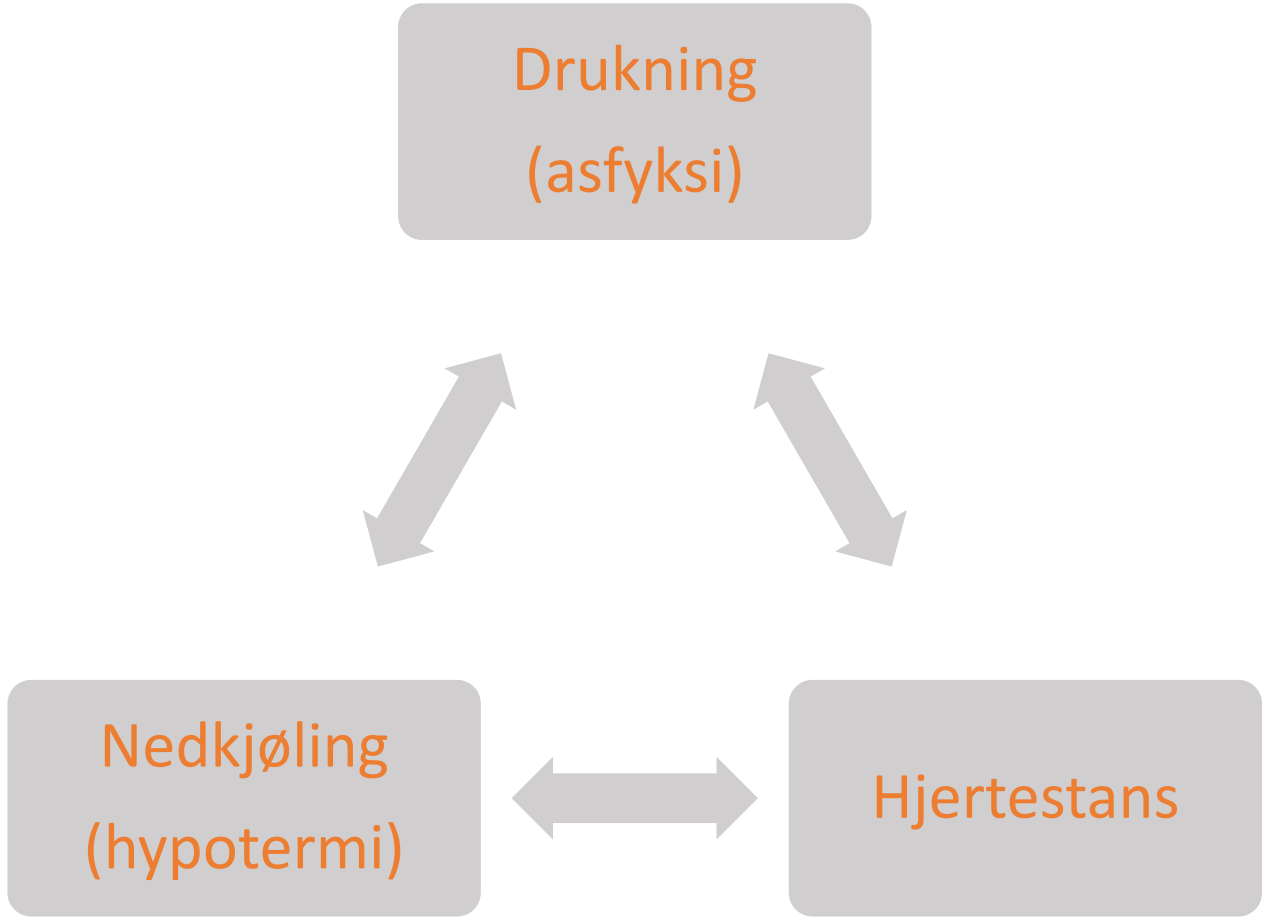
2021
VA Sirk.svikt/lunge-svikt
VV/lungesvikt
Postcardiotomy
ECPR
Aksidentiell hypotermi

Et hjerte som har stanset pga hypotermi vil ikke starte igjen før det blir varmet opp!
(«Ingen er død før varm og død...»)

VA ECMO:




Drukning
(asfyksi)
Nedkjøling
(hypotermi)
Hjertestans

Drowning

ILCOR definition:

… a process resulting in primary respiratory impairment from submersion/immersion in a liquid medium…

…The key feature to note in the pathophysiology of drowning is that cardiac arrest occurs as a consequence of hypoxia…

Asfyksi: redusert oksygentilførsel pga obstruerte luftveier, dvs drukning og andre typer kvelninger

Asfyksi: ØNH-problemstilling
Dysoksi av annen årsak: Lungemedisinsk problemstilling
Hjertestans: Kardiologisk problemstilling
Hypoterm hjertestans: Thorax-kirurgisk problemstilling
... men alltid en **anestesiologisk** problemstilling!

Hypothermia – classification

Swiss system	Symptoms	By degree	Temperature
Stage 1	Awake and shivering	Mild	32 – 35 °C
Stage 2	Drowsy and not shivering	Moderate	28 – 32 °C
Stage 3	Unconscious and not shivering	Severe	20 – 28 °C
Stage 4	No vital signs	Profound	< 20 °C

The risk of cardiac arrest increases as the core temperature drops below 32°C, and increases substantially if the temperature is less than 28°C.

Behandling hypotermi

- Stage 1:
  - warm clothing/environment
  - encourage active movement
- Stage 2 & 3:
  - minimize movements to prevent arrhythmias
  - active heating
  - intubation?
- Stage 4
  - CPR
  - rewarming ECMO/CPB

If a heart stops from hypothermia, it will not start again unless rewarmed!

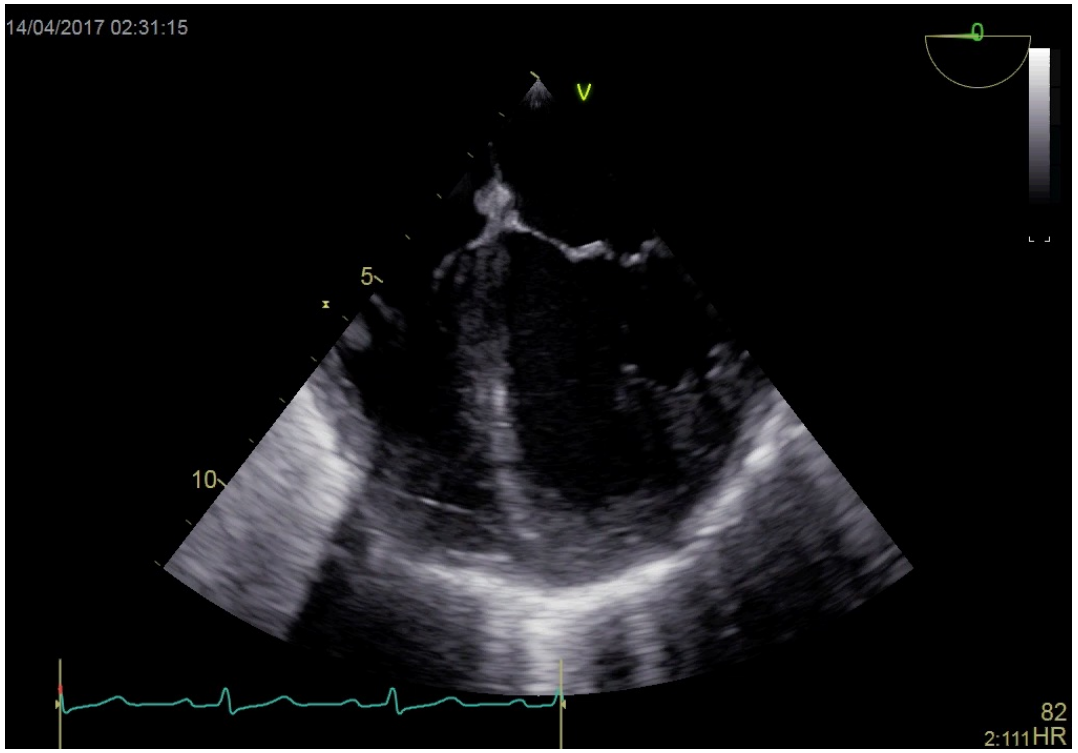
Practical stage 4 rewarming

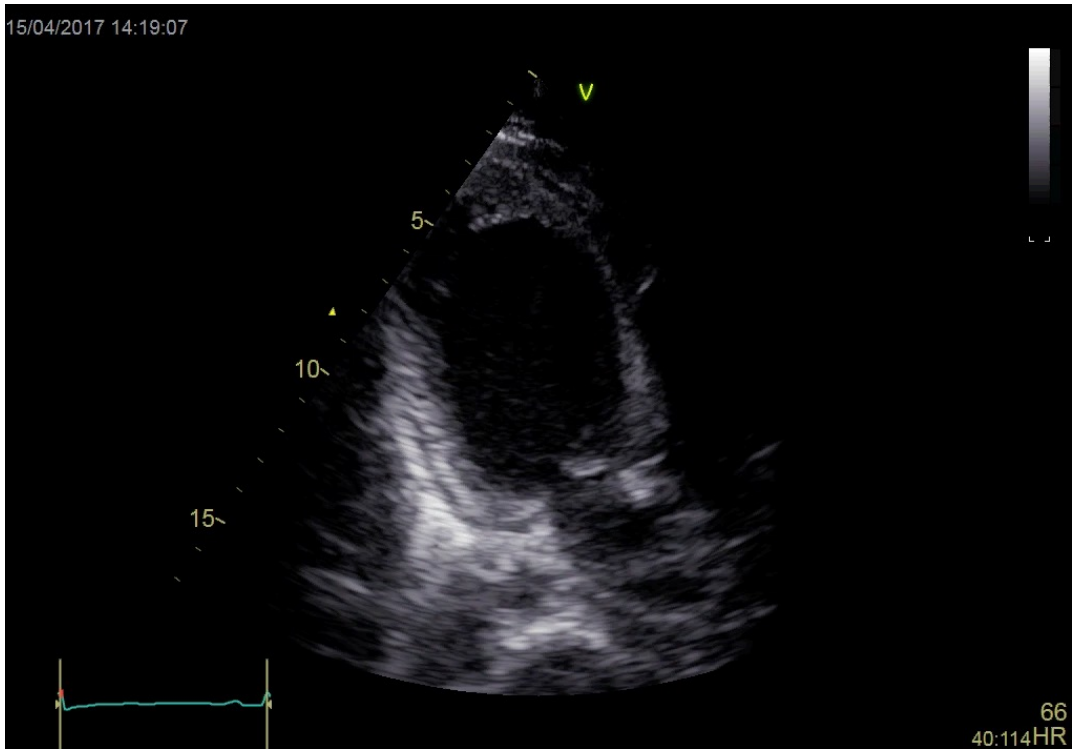
- CPB/ECMO is the solution to A, B and C!
- This means: fast femoral cannulation and machine-start
- Venous and arterial access as well as all medications should wait
- We prefer ECMO over CPB
- Be prepared for a long night in the theatre and in the intensive ward – you will get all kinds of challenges...

Post resuscitation care

- Heart failure with lung oedema-> continuous ECMO
- Primary ALI/ARDS -> continuous ECMO
- Peripheral circulation / compartment syndrome -> fasciotomies
- Multiple Organ Dysfunction Syndrome
- Therapeutic hypothermia
  - Pro: neuroprotection?
  - Con: bleeding?
- Fluids/transfusions, vasoactive drugs, anticoagulation, antibiotics...

Hjertesvikt





Lungesvikt

Forensic Sci Med Pathol (2014) 10:557–569
DOI 10.1007/s12024-014-9611-2

ORIGINAL PAPER

Postmortem pulmonary CT in hypothermia

Wolf Schweitzer · Michael Thali · Giannina Giugni · Sebastian Winklhofer

Pulmonary PMCT attenuation in fatal hypothermia, as well as autopsy lung weights, was found to be significantly lower compared to age-sex matched controls. However, we

Ferskvann vs. sjøvann

EXPERIMENTAL AND THERAPEUTIC MEDICINE 13: 2591-2598, 2017

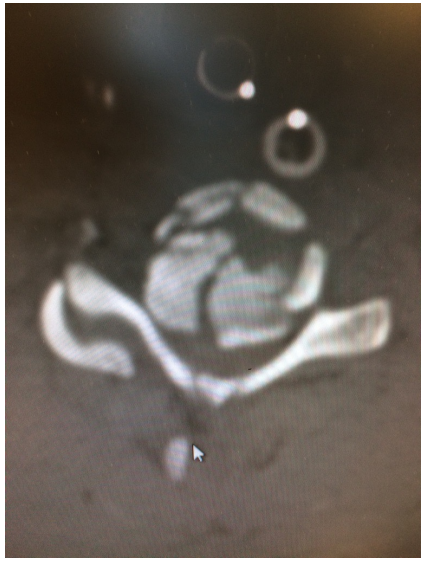
Seawater-drowning-induced acute lung injury: From molecular mechanisms to potential treatments (Review)

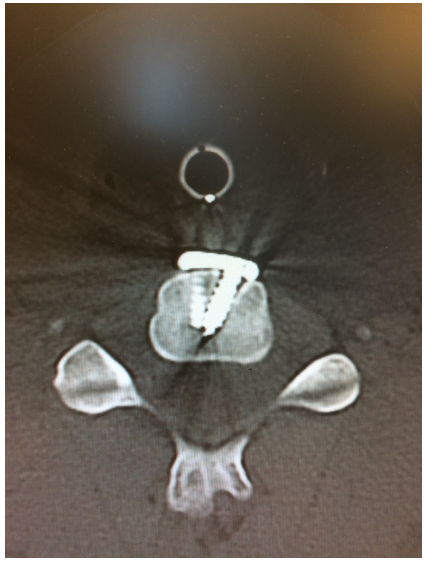
FAGUANG JIN and CONGCONG LI

Department of Respiratory and Critical Care Medicine, Tangdu Hospital, The Fourth Military Medical University, Xi'an, Shaanxi 710038, P.R. China

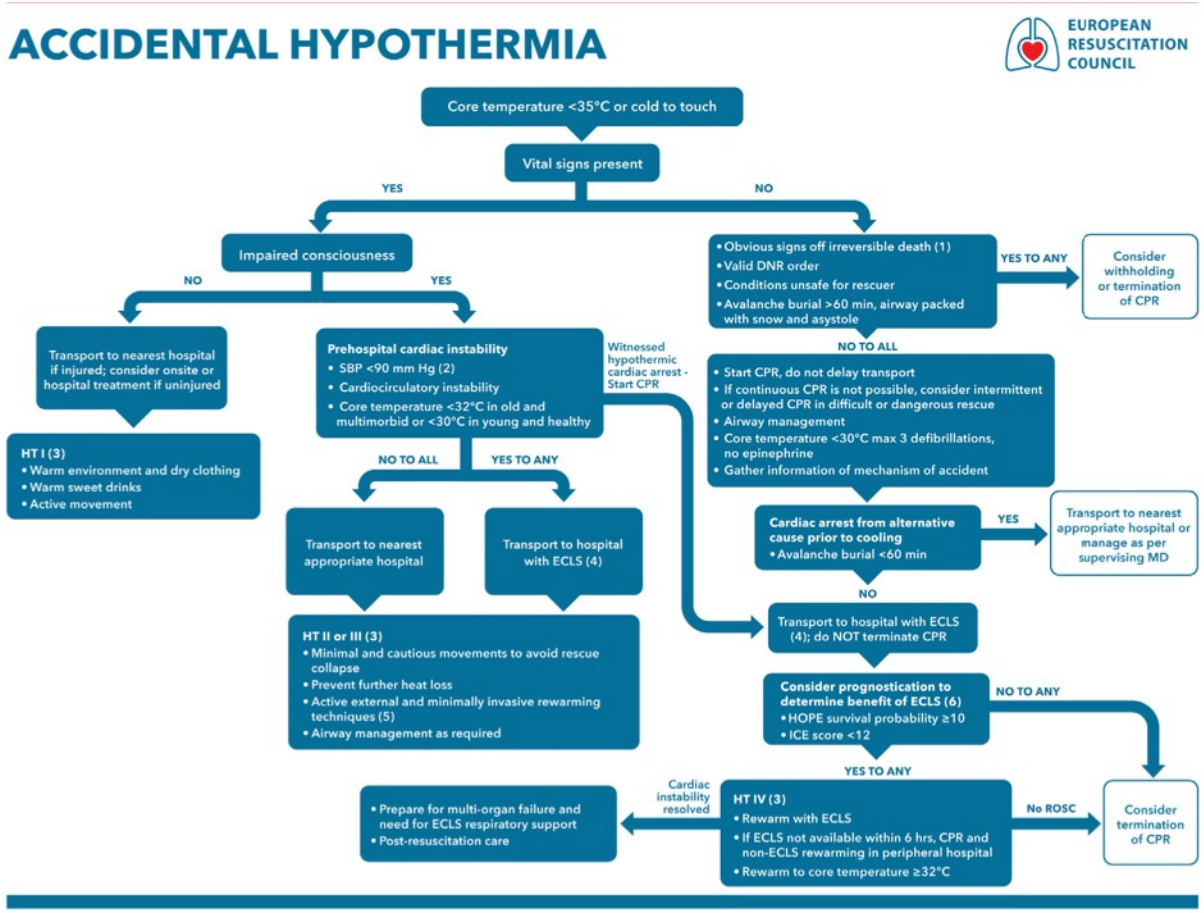
- ✓ Seawater is hyperosmolar (942 mOsm/kg) -> fluid enters the alveolar space
- ✓ Inflammatory response with alveolar septum widening and alveolar membrane damage
- ✓ Surfactant dilution and washing
- ✓ Pathogen invasion
- ✓ Oxidative stress, autophagy and apoptosis,

Nevrokirurgi med ECMO…





ILCOR guidelines



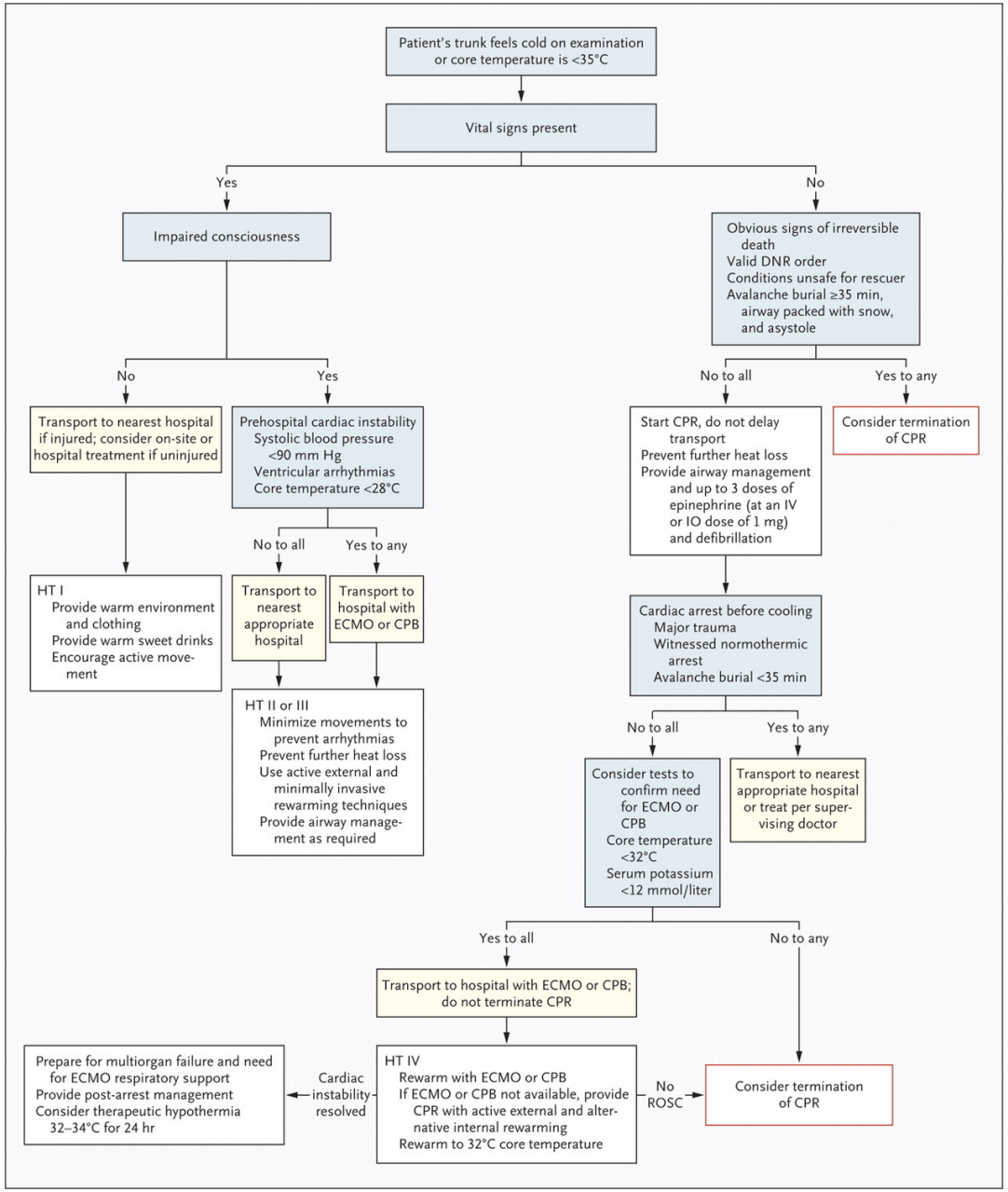
Hypothermia

Accidental hypothermia

- Assess core temperature with a low reading thermometer, tympanic in spontaneously breathing, oesophageal in patients with a tracheal tube or a supraglottic device with an oesophageal channel in place (Fig. 5).
- Check for the presence of vital signs for up to one minute.
- Prehospital insulation, triage, fast transfer to a hospital and rewarming are key interventions.
- Hypothermic patients with risk factors for imminent cardiac arrest (i.e., core temperature <30 °C, ventricular arrhythmia, systolic blood pressure <90 mmHg) and those in cardiac arrest should ideally be directly transferred to an extracorporeal life support (ECLS) centre for rewarming.
- Hypothermic cardiac arrest patients should receive continuous CPR during transfer.
- Chest compression and ventilation rate should not be different to CPR in normothermic patients.
- If ventricular fibrillation (VF) persists after three shocks, delay further attempts until the core temperature is >30 °C.
- Withhold adrenaline if the core temperature is <30 °C.
- Increase administration intervals for adrenaline to 6–10 min if the core temperature is >30 °C.
- If prolonged transport is required or the terrain is difficult, use of a mechanical CPR device is recommended.
- In hypothermic arrested patients <28 °C delayed CPR may be used when CPR on site is too dangerous or not feasible, intermittent CPR can be used when continuous CPR is not possible (Fig. 6).

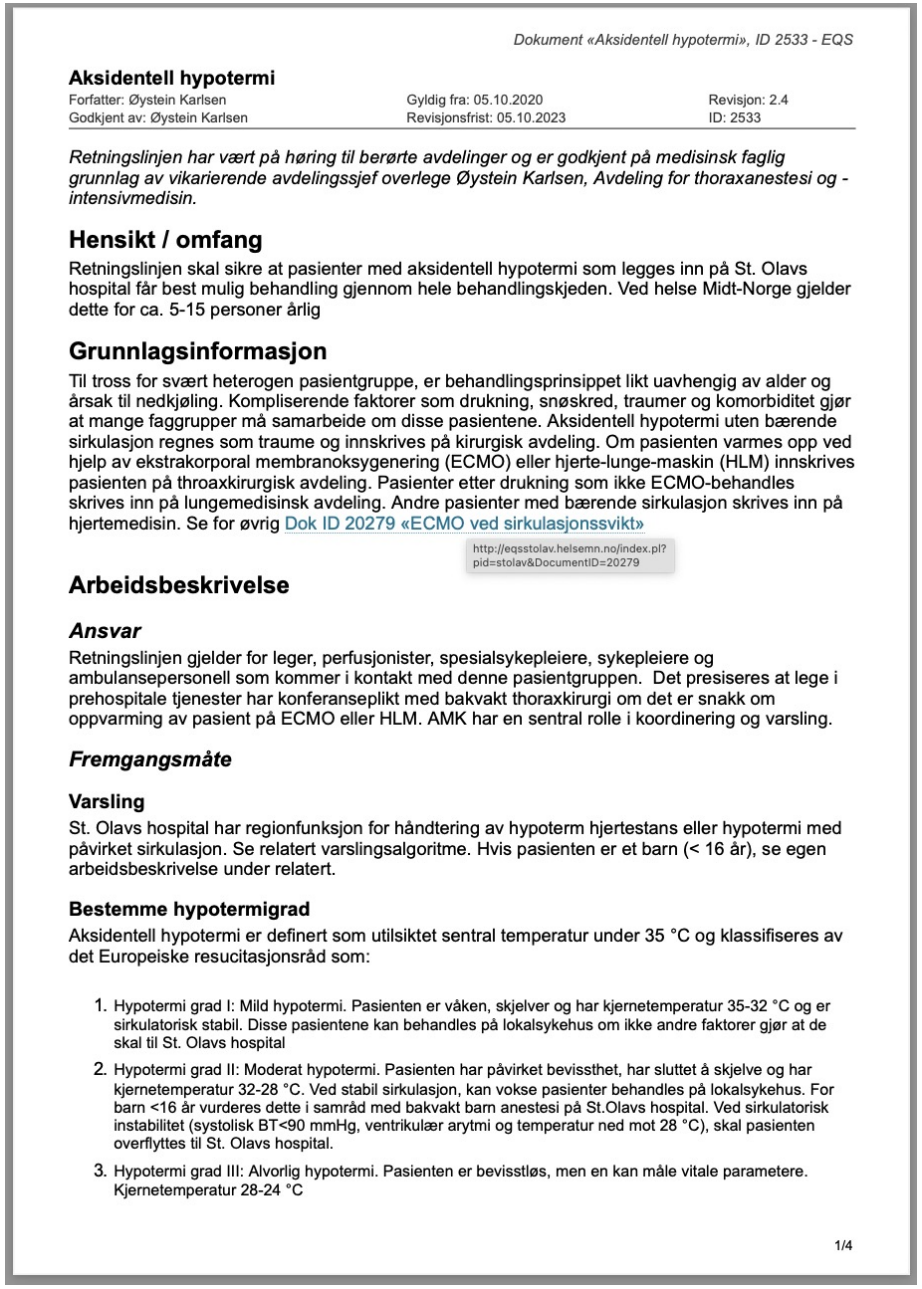
- In-hospital prognostication of successful rewarming should be based on the HOPE or ICE score. The traditional in-hospital serum potassium prognostication is less reliable.
- In hypothermic cardiac arrest rewarming should be performed with ECLS, preferably with extra-corporeal membrane oxygenation (ECMO) over cardiopulmonary bypass (CPB).
- Non-ECLS rewarming should be initiated in a peripheral hospital if an ECLS centre cannot be reached within hours (e.g. 6 h).

Flytskjema



D J A Brown et al: Accidental hypothermia. New Eng J Med 2012; 367:1930-38

Regional retningslinje



Aksidentell hypotermi

Forfatter: Øystein Karlsen | Gyldig fra: 05.10.2020 | Revisjon: 2.4
Godkjent av: Øystein Karlsen | Revisjonsfrist: 05.10.2023 | ID: 2533

Retningslinjen har vært på høring til berørte avdelinger og er godkjent på medisinsk faglig grunnlag av vikarierende avdelingssjef overlege Øystein Karlsen, Avdeling for thoraxanestesi og -intensivmedisin.

Hensikt / omfang

Retningslinjen skal sikre at pasienter med aksidentell hypotermi som legges inn på St. Olavs hospital får best mulig behandling gjennom hele behandlingskjeden. Ved helse Midt-Norge gjelder dette for ca. 5-15 personer årlig

Grunnlagsinformasjon

Til tross for svært heterogen pasientgruppe, er behandlingsprinsippet likt uavhengig av alder og årsak til nedkjøling. Kompliserende faktorer som drukning, snøskred, traumer og komorbiditet gjør at mange faggrupper må samarbeide om disse pasientene. Aksidentell hypotermi uten bærende sirkulasjon regnes som traume og innskrives på kirurgisk avdeling. Om pasienten varmes opp ved hjelp av ekstrakorporal membranoksygenering (ECMO) eller hjerte-lunge-maskin (HLM) innskrives pasienten på throaxkirurgisk avdeling. Pasienter etter drukning som ikke ECMO-behandles skrives inn på lungemedisinsk avdeling. Andre pasienter med bærende sirkulasjon skrives inn på hjertemedisin. Se for øvrig Dok ID 20279 «ECMO ved sirkulasjonssvikt»

http://eqsstolav.helsemn.no/index.pl?pid=stolav&DocumentID=20279

Arbeidsbeskrivelse

Ansvar

Retningslinjen gjelder for leger, perfusjonister, spesialsykepleiere, sykepleiere og ambulansepersonell som kommer i kontakt med denne pasientgruppen. Det presiseres at lege i prehospitale tjenester har konferanseplikt med bakvakt thoraxkirurgi om det er snakk om oppvarming av pasient på ECMO eller HLM. AMK har en sentral rolle i koordinering og varsling.

Fremgangsmåte

Varsling

St. Olavs hospital har regionfunksjon for håndtering av hypoterm hjertestans eller hypotermi med påvirket sirkulasjon. Se relatert varslingsalgoritme. Hvis pasienten er et barn (< 16 år), se egen arbeidsbeskrivelse under relatert.

Bestemme hypotermigrad

Aksidentell hypotermi er definert som utilsiktet sentral temperatur under 35 °C og klassifiseres av det Europeiske resucitasjonsråd som:

1. Hypotermi grad I: Mild hypotermi. Pasienten er våken, skjelver og har kjernetemperatur 35-32 °C og er sirkulatorisk stabil. Disse pasientene kan behandles på lokalsykehus om ikke andre faktorer gjør at de skal til St. Olavs hospital
2. Hypotermi grad II: Moderat hypotermi. Pasienten har påvirket bevissthet, har sluttet å skjelve og har kjernetemperatur 32-28 °C. Ved stabil sirkulasjon, kan vokse pasienter behandles på lokalsykehus. For barn <16 år vurderes dette i samråd med bakvakt barn anestesi på St.Olavs hospital. Ved sirkulatorisk instabilitet (systolisk BT<90 mmHg, ventrikulær arytmi og temperatur ned mot 28 °C), skal pasienten overflyttes til St. Olavs hospital.
3. Hypotermi grad III: Alvorlig hypotermi. Pasienten er bevisstløs, men en kan måle vitale parametere. Kjernetemperatur 28-24 °C

Prognostisering

$sK^+ < 12$ mM

Contents lists available at ScienceDirect

Resuscitation

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

Clinical paper

Hypothermia outcome prediction after extracorporeal life support for hypothermic cardiac arrest patients: The HOPE score☆

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ARTICLE INFO

Keywords:
Cardiac arrest
ECMO
ECPR
Hypothermia
Accidental
Potassium
Resuscitation
Triage

ABSTRACT

Aims: Currently, the decision to initiate extracorporeal life support for patients who suffer cardiac arrest due to accidental hypothermia is essentially based on serum potassium level. Our goal was to build a prediction score in order to determine the probability of survival following rewarming of hypothermic arrested patients based on several covariates available at admission.

Methods: We included consecutive hypothermic arrested patients who underwent rewarming with extracorporeal life support. The sample comprised 237 patients identified through the literature from 18 studies, and 49 additional patients obtained from hospital data collection. We considered nine potential predictors of survival: age; sex; core temperature; serum potassium level; mechanism of hypothermia; cardiac rhythm at admission; witnessed cardiac arrest, rewarming method and cardiopulmonary resuscitation duration prior to the initiation of extracorporeal life support. The primary outcome parameter was survival to hospital discharge.

Results: Overall, 106 of the 286 included patients survived (37%; 95% CI: 32–43%), most (84%) with a good neurological outcome. The final score included the following variables: age, sex, core temperature at admission, serum potassium level, mechanism of cooling, and cardiopulmonary resuscitation duration. The corresponding area under the receiver operating characteristic curve was 0.895 (95% CI: 0.859–0.931) compared to 0.774 (95% CI: 0.720–0.828) when based on serum potassium level alone.

Conclusions: In this large retrospective study we found that our score was superior to dichotomous triage based on serum potassium level in assessing which hypothermic patients in cardiac arrest would benefit from extracorporeal life support. External validation of our findings is required.