



CARDIOPULMONARY RESUSCITATION AFTER CARDIAC ARREST

Acute treatment with hypothermia

PROTOCOL AND CHECKLIST ICU IN-HOSPITAL AND OUT-OF-HOSPITAL CARDIAC ARREST

Background

Treatment with postischemic universal hypothermia protects against brain damage and improves life quality and survival after cardiac arrest.

More than 750 000 Europeans yearly undergo sudden and unexpected cardiac arrest. Survival after in-hospital cardiac arrest is less than 20% and after out-of-hospital cardiac arrest less than 5%, numbers which have been unchanged for decades. Patients with return of spontaneous circulation after cardiac arrest who die later often die from their anoxic brain damage inflicted upon them during the no-flow state. Recently, two independent studies have shown that early treatment with hypothermia protects from neurologic sequelae (NEJM; Feb 21, 2002) and one of the two studies showed an increased survival rate as well. Body temperature is usually spontaneously lowered to 35-36°C soon after cardiac arrest but is normalized within 1-2 hours. Hypothermia treatment may of practical reasons rarely be initiated in the clinical setting until 30-120 min after cardiac arrest and should be continued for at least 12-24 hours in order to protect from brain damage.

Treated patients in the studies above had an initial rhythm of VT/VF and the time of the “no-flow” state was known and limited, in one study ≤ 15 min until start of CPR. However, it is reasonable to consider hypothermia treatment in all patients who have return of spontaneous circulation (ROSC) after cardiac arrest and where you wish to continue active treatment, regardless of whether the initial rhythm was VT/VF or some other rhythm (PEA/Asystole). Patients in cardiogenic shock need above all to reperfuse their myocardium but hypothermia treatment may be considered while waiting for intervention. The published studies were performed in adult patients (age 18-75) but we do not mention or recommend any specific age limits in this protocol. There is, as of yet, no experience from treating children. Evidence-based treatment recommendations were recently published (ILCOR, *Resuscitation* 57(2003)231).

PATIENTS WHO SHOULD BE CONSIDERED FOR HYPOTHERMIA TREATMENT

- Return of spontaneous circulation (ROSC; systolic BP \geq 80 for \geq 5 min)
- Unconscious patient (RLS $>$ 3, GCS $<$ 8) until initiation of treatment ($<$ 240 min)

PATIENTS WHO SHOULD NOT BE TREATED WITH HYPOTHERMIA

- Primary coagulopathi (dikumarol treatment no contraindication)
- Terminal disease
- Cardiac arrest secondary to trauma
- Cardiac arrest secondary to aortic dissection, i.c. hemorrhage or to other massive bleeding



CARDIOPULMONARY RESUSCITATION AFTER CARDIAC ARREST

Acute treatment with hypothermia

PROTOCOL AND CHECKLIST ICU – IN-HOSPITAL AND OUT-OF-HOSPITAL CARDIAC ARREST

ESTIMATED DURATION OF INTERVENTIONS

Time between cardiac arrest and basic CPR.....min	Time between cardiac arrest and circulation (palp. pulse).....min
Time between cardiac arrest and defibrillation.....min	Time between cardiac arrest and arrival ER.....min

MEASURES TO TAKE BY ICU-DOCTOR ON CALL

Arrival ICU (date and time)	Time from cardiac arrest until initiation of cooling.....min
--------------------------------------	--

- Clinical examination including clinical neurological examination
- Contact the "hypothermia-dr on call" - minicall: ____ - ____ – to discuss the specific patient.
- Contact and inform the particular patient-responsible physician ("PAL")
- Can the patient be included to hypothermia treatment?

Yes No Signature.....

If No – describe why:.....
If Yes – continue below:

- Inform responsible nurse about the planned treatment. Activate cold NaCl, cooling cap, TOF-device, catheter with temp.probe and cooling device of choice.
- Intraarterial access, periferal lines, central venous cath and gastric tube (CVC may wait)
- Assign acute bloodtests according to protocol and measure temperature
- Assign ECG, pulmonary X-ray (OK with cooling dress), UCG when possible
- Assign and start treatment according to study protocol (p.3)

Responsible: _____ (mail: _____@_____)



CARDIOPULMONARY RESUSCITATION AFTER CARDIAC ARREST

Acute treatment with hypothermia

HYPOTHERMIA TREATMENT IN THE ICU

The patient should be intubated and normoventilated and:

- *sedated* with inf Propofol (40-100 mg/h) or Fentanyl $\leq 2 \mu\text{g/kg/h}$ + inf Dormicum $\leq 0.1 \text{ mg/kg/h}$.
- *paralyzed* with inj Esmeron 0.6 mg/kg during cooling and rewarming.

Initiate cooling as soon as possible:

- Rapid infusion of cold NaCl (+4°C): **30 ml/kg, 100 ml/min**

Two large periferal cannulas (16G) are needed – infuse with pressure.

For *example*: A patient of 70 kg – infuse 2100 ml Ringer-ac in 21 min.

Continue to compensate diuresis with cold NaCl until goal temp. has been achieved

- Continued cooling of the patient can be performed with different regimens:
 - Icebags (ice and water in plastic bags) which are applied in groins, armpits and neck. This method was used by Bernard et al. in one of the published studies.
 - Other methods of external cooling. In the European study, convection cooling with cold air was used (TheraKool®). In Lund- Malmö-Helsingborg we have experience using the Thermowrap®, a cooling dress with circulating water. This method offers a good temperature control during cooling and rewarming.
 - Invasive cooling with a cold catheter placed via v femoralis – in Europe there is yet just one with CE-approval (IcyCath®).
- When goal temp 33°C has been reached, muscle relaxants may be withdrawn. Relaxants are reintroduced if shivering occurs and always during rewarming. Relaxants are withdrawn at 36°C and reversal at 37°C with iv Robinul-Neostigmin 1ml. Sedation is stopped at 37°C if acceptable TOF. Extubation according to common criteria.
- Cooling at 33°C should continue for 24 h and slow rewarming to 37°C during 8 h, 0.5°C/h

TREATMENT IN THE ICU



CARDIOPULMONARY RESUSCITATION AFTER CARDIAC ARREST

Acute treatment with hypothermia

OTHERS (drugs, other examinations etc):

- Consider cardiac intervention according to local protocol; thrombolysis, PCI.
Hypothermia-treatment is no contraindication for cardiac intervention.
- Apply the local protocol for cardiac patients (ASA, heparin, beta-blockade etc)
- Ulcusprophylaxis, H₂-blocker Zantac 25 mg/ml, 1-2 ml x 3 or similar
- Antithrombosis prophylaxis
- Relevant antibiotics after relevant cultures in case of infection.
- Pulmonary x-ray after CVC and when needed
- CT-brain if cause of unconsciousness other than anoxic brain damage is suspected

- Comments, notes and possible complications should be noted (see attachment 1).
- Patients who die should be examined postmortem – pathological / neuropathological diagnostics - after acceptance from relatives.
- Register treated patients in our common internet protocol which you will find on our homepage: <http://www.scctg.org> - this makes evaluation and follow-up possible

- Outcome measures:
Cerebral Performance Category (CPC) at discharge from ICU and at 6 months.
Clinical neurological examination at 6 months incl evaluation by an occupational therapist of the patient's function (based on ADL) and cognitive testing.
Survival at 72 hours and at 6 months (=primary outcome).



CARDIOPULMONARY RESUSCITATION AFTER CARDIAC ARREST

Acute treatment with hypothermia

COOLING TREATMENT - PROTOCOL

COOLING INITIATED	Date and time:
GOAL TEMPERATURE REACHED	Date and time:
COOLING STOPPED	Date and time:
NORMOTHERMIA (37°C)	Date and time:

TEMPERATURE PROTOCOL

(register every 15 min until temp. 33 °C is reached, thereafter x 1/hour)

Time:								
Temp: KAD Tympanon PiCCO								

Time:								
Temp: KAD Tympanon PiCCO								

Time:								
Temp: KAD Tympanon PiCCO								

NOTE! During cooling, catheter-temp may show a false high temp as compared to "true" core temperature due to delay (if diureses <250ml/h). Tympanic temp may show a more "true" core temp in this situation and can be used as reference temp.

COMMENTS AND COMPLICATIONS

Responsible: _____ (mail: _____ @ _____)



CARDIOPULMONARY RESUSCITATION AFTER CARDIAC ARREST

Acute treatment with hypothermia

Be careful and register complications that occur - known complications to hypothermia are arrhythmia, severe infections, bleedings - also note occurrence of convulsions!

Arrhythmias

Yes

No

Rhythm? Time? _____

Treatment? _____

Infection

Yes

No

Locus? Time? _____

Treatment? _____

Bleeding

Yes

No

Locus? Time? _____

Treatment? _____

Convulsions

Yes

No

Time? _____

Treatment? _____

Other: _____

Responsible: _____ (mail: _____ @ _____)