Therapeutic hypothermia, the forgotten maneuver

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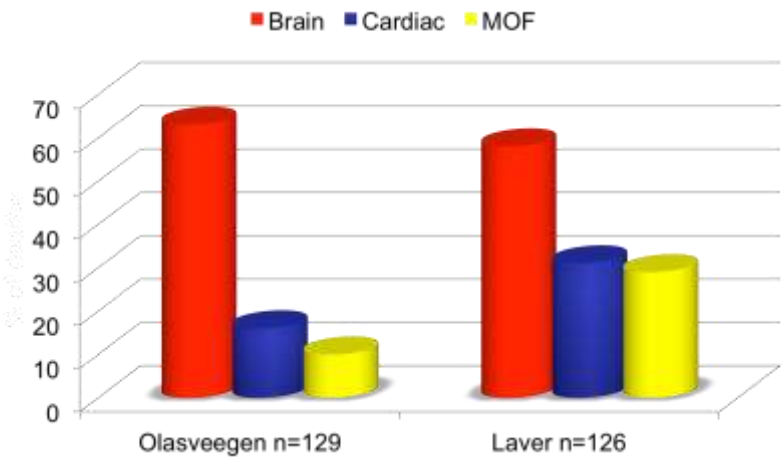
Causes of death after CPR



What happens to the brain and the heart during CPR ?

- During cardiac arrest there is hypo-perfusion and hypoxemia of vital organs.
- Reperfusion is associated with free radical formation and significant inflammation of the brain and the heart
- This leads to mitochondrial damage and apoptosis (programmed cell death).

Need for organ (neuro) –protective therapy

Mechanisms of hypothermia

- Reduced levels of glutamate, aspartate, acetylcholine
- Reduced levels of lactate
- Decreased cellular inflammatory response
- Promotes preservation of the blood brain barrier
- Decreased edema
- Decreased O2 consumption and CO2 production
- Decreases metabolic rate: for each 1° C ↓ in temperature, there is a 6%-7% ↓ in cerebral metabolic rate

New studies show that the heart benefits also. Hypothermia may decrease the area of injury, promote epicardial reflow, decrease myocardial metabolic demand, and preserve intracellular high-energy phosphate stores.

Two landmark clinical trials

For every six patients treated, one life saved

The New England Journal of Medicine, 2002

European : HACA Trial

- 275 patients randomized to cooling or normal temps
- Cooling time: 6.5 hrs to 34ºC using surface cooling

Results:	*Hypothermia*	Normothermia	
Good Outcome	*55%*	39%	p=0.009
Mortality	*41%*	55%	p=0.02

Australian Study:

- 77 patients randomized
- Used ice packs to cool; Cooling rate .9 C/hour

Results:	*Hypothermia*	Normothermia	
Good Outcome	*49%*	26%	p=0.046
Mortality	*51%*	68%	P=NS

33° versus 36° after CPR

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Targeted Temperature Management at 33°C versus 36°C after Cardiac Arrest

Table 2. Outcomes.

Outcome	33°C Group	36°C Group	Hazard Ratio or Risk Ratio (95% CI)*	P Value
	no./total no. (%)			
Primary outcome: deaths at end of trial	235/473 (50)	225/466 (48)	1.06 (0.89–1.28)	0.51
Secondary outcomes				
Neurologic function at follow-up†				
CPC of 3–5	251/469 (54)	242/464 (52)	1.02 (0.88–1.16)	0.78
Modified Rankin scale score of 4–6	245/469 (52)	239/464 (52)	1.01 (0.89–1.14)	0.87
Deaths at 180 days	226/473 (48)	220/466 (47)	1.01 (0.87–1.15)	0.92

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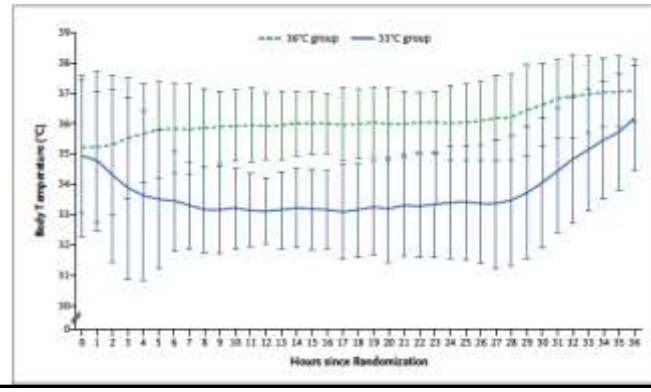


Guideline recommendations

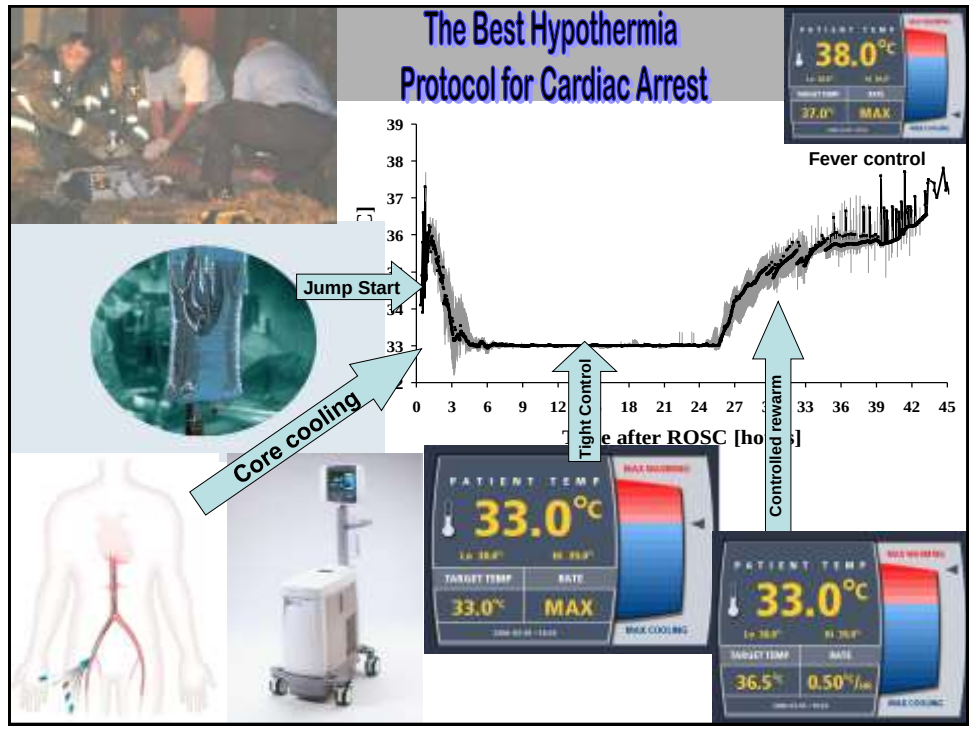
American Heart Association
AHA
Recommendations

- ***Class I, LOE B: for VF and out-of-hospital arrest (NEW for 2010)***
- *Class IIb, LOE B:* for non-VF (PEA and asystole) and in-hospital arrest
- **Class I, LOE C: actively intervene to avoid hyperthermia post ROSC**

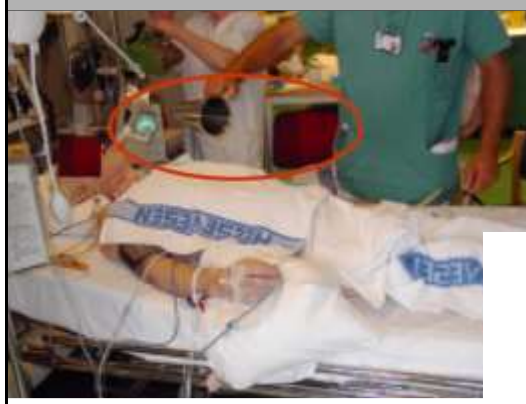
International Liaison Committee on Resuscitation
ILCOR
Recommendations

Level I evidence

- Unconscious adult patients with spontaneous circulation after out-of-hospital cardiac arrest should be cooled to 32-34° C for 12-24 hours when the initial rhythm was ventricular fibrillation (VF).
- Such cooling may also be beneficial for other rhythms or in-hospital cardiac arrest.

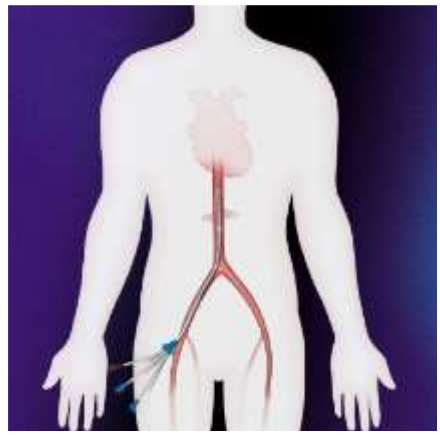


Non-invasvie Cooling-methods

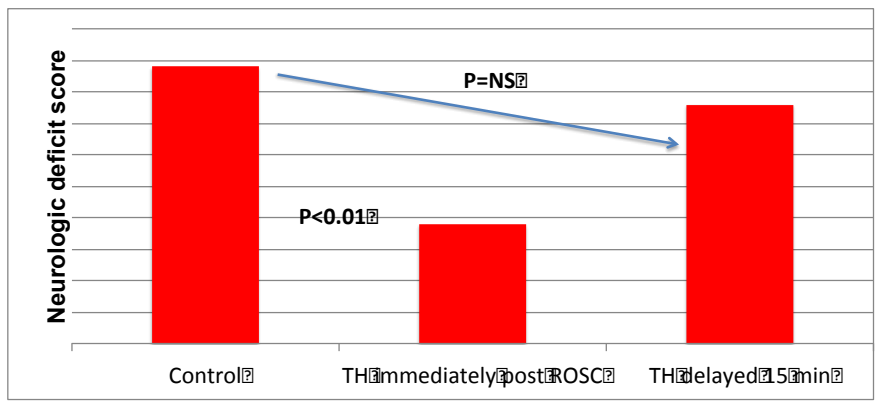


Invasive cooling

Thermogard XP (TGXP, ZOLL Medical)



Timing of Cooling

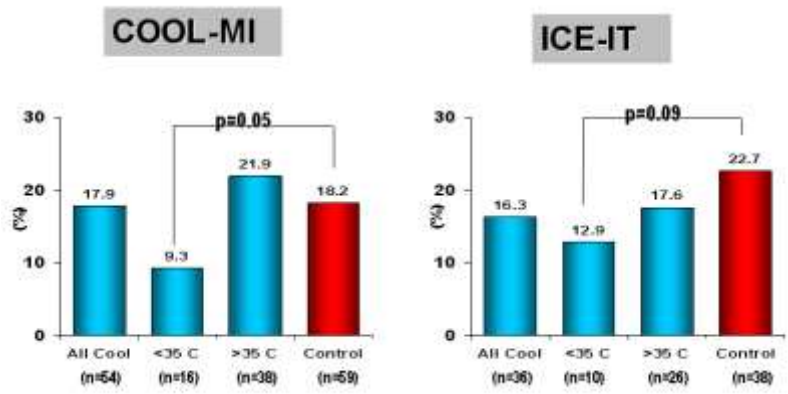


Kuboyama Crit Care Med 1993

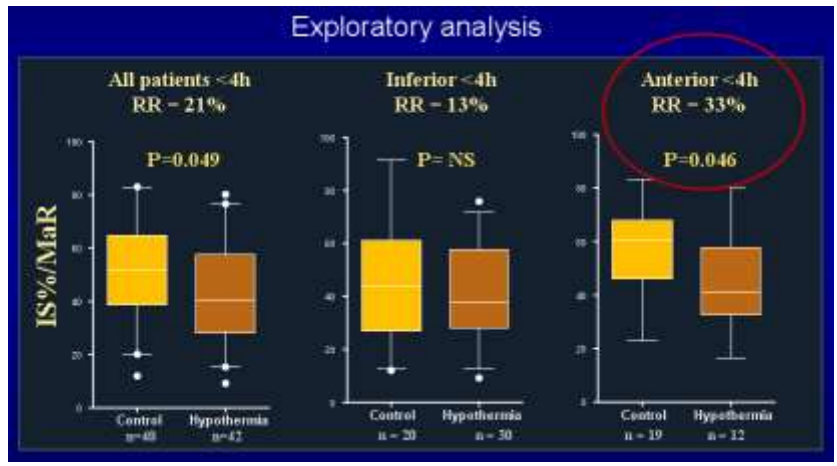
Cooling and PCI

- ✓In STEMI patients primary PCI should not be delayed
- ✓But cooling should be started simultaneously (cool packs, ice,invasive cooling)
- ✓Cooling could be beneficial both for the brain and the heart

Effect of cooling on infarct-size after primary PCI COOL-MI und ICE-IT



CHILL-MI trial



TCT 2013, Erlinge JACC 2014

Conclusion

- ✓ So far cooling is the only proven neuro-protective therapy after CPR
- ✓ Cooling should be started as early as possible after CPR
- ✓ The optimal temperature for neuroprotection still has to be defined, most likely 34-35 °
- ✓ For protection of the heart coolling should be started before primary PCI with a temperature goal of 34°