

Therapeutic Hypothermia After Cardiac Arrest

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No conflicts of interest

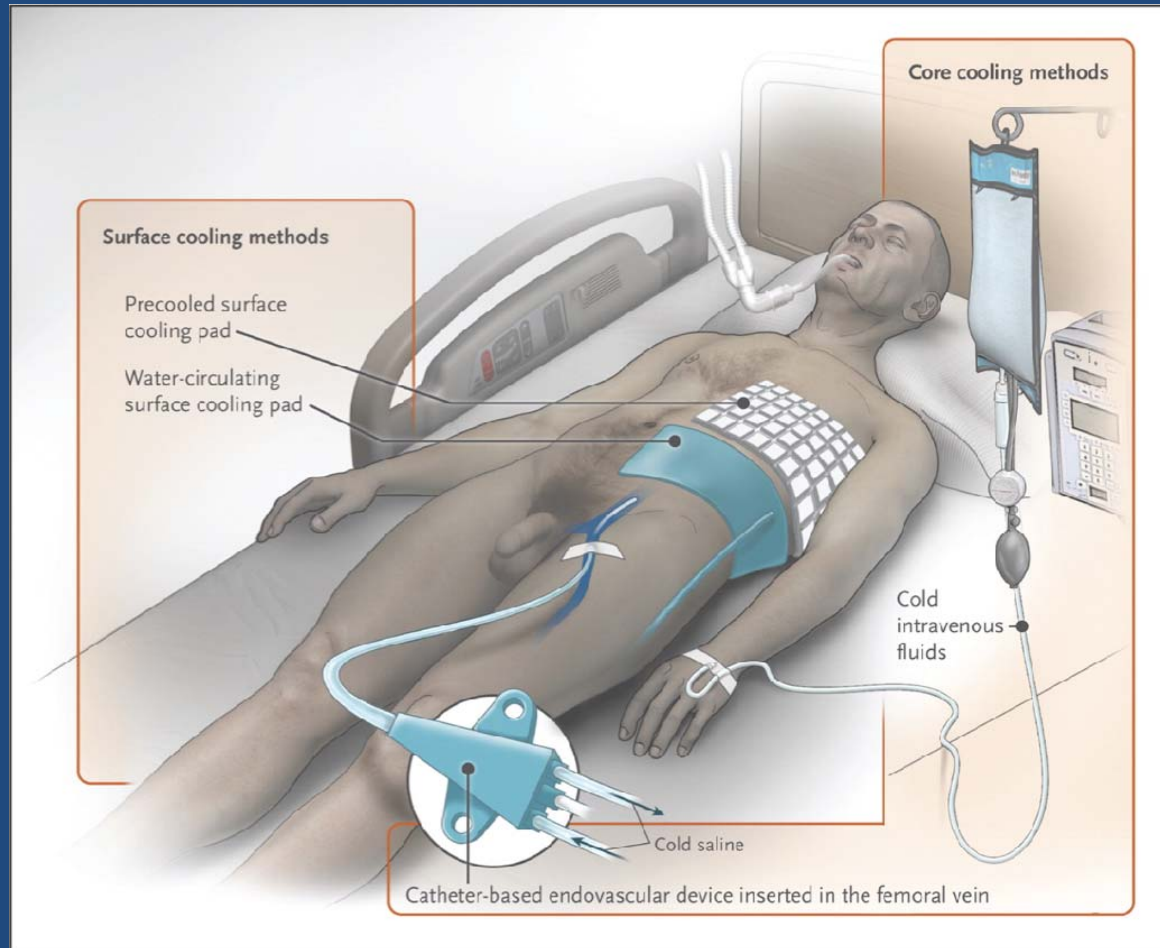
Out of Hospital Cardiac Arrest

- 300,000 annually
- Survival 6% - 9%
- Severe neurologic impairment in survivors common.
- Mild therapeutic hypothermia applied to some survivors.

Therapeutic Hypothermia

- How is it done?
- How does it work?
- What is the supporting data?
- What don't we know?

Cooling Methods



External Cooling



External Cooling



Inflated Mode

Therapeutic Hypothermia Phases

- Induction:
 - cool to 32-34 degrees (C) for 24 hrs
 - concomitant neuromuscular blockade
- Maintenance:
 - Central temperature monitoring to avoid swings
- Re-warming:
 - 0.25 - 0.50 degree (C) per hour

Possible Mechanisms

- Decrease cerebral metabolism
- Decrease brain consumption of glucose and oxygen
- Decrease mediators of cytotoxic injury
- Decrease production of nitric oxide and excitotoxins
- Retards breakdown of blood brain barrier
- Reduces cell death

Hypothermia Complications

- Shivering
- Increase SVR, decrease CO
- Bradycardia/arrhythmias
- Diuresis and volume depletion
- Hyperglycemia from decreased insulin sensitivity
- Increased bleeding from impaired platelet and clotting function
- Increased infection from impaired immune function
- Reduced clearance of sedative and paralytic drugs

HACA Study

(NEJM 2002;346:549-56)

- 3551 patients screened
- 273 patients resuscitated after witnessed cardiac arrest (VF or VT) were randomized to mild hypothermia or standard treatment
- Primary endpoint: “favorable” neurologic outcome within six months
- Secondary endpoint: mortality at six months and complications within seven days

HACA Study – Neurologic Outcome

(NEJM 2002;346:549-56)

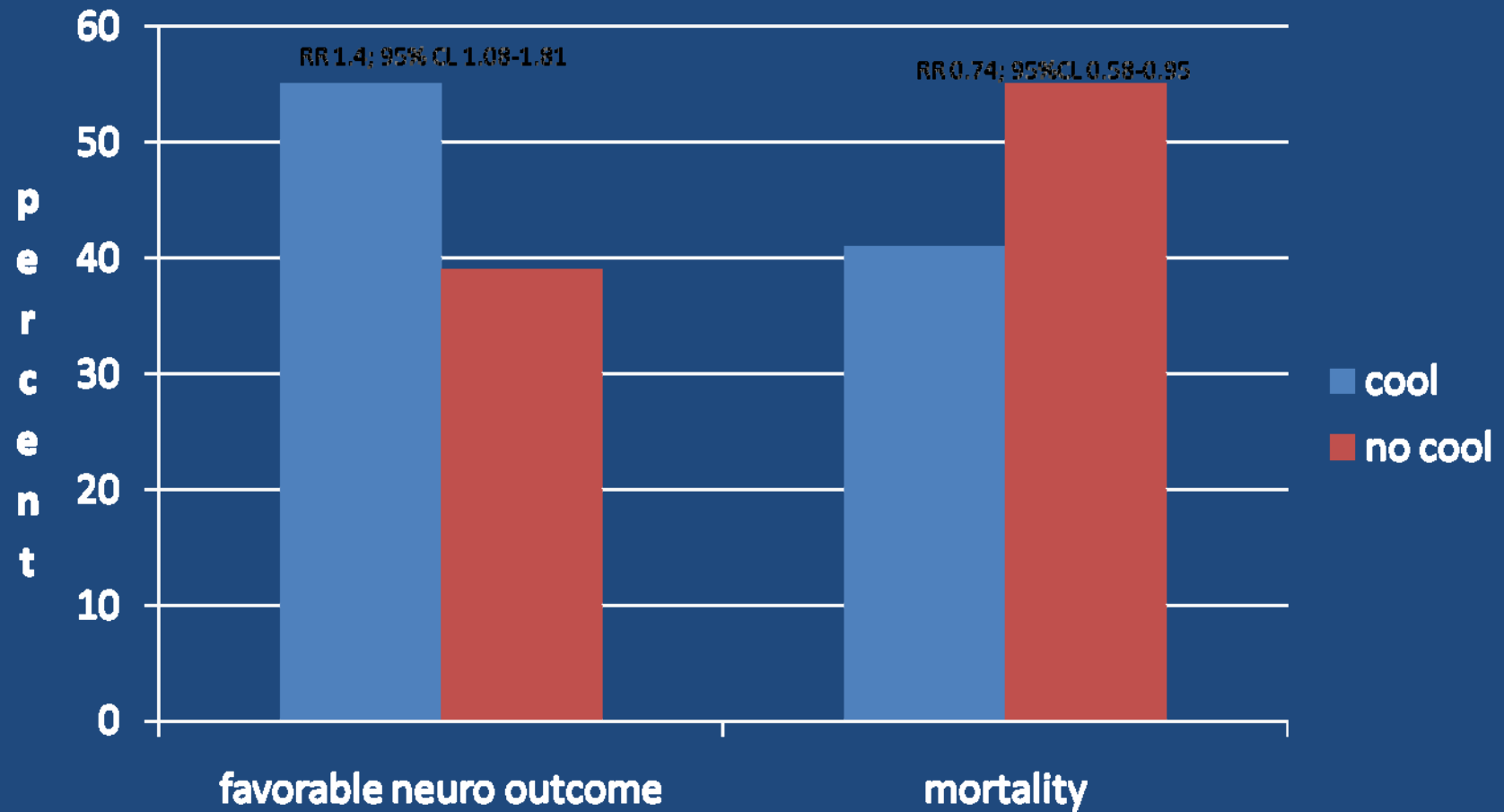
Pittsburgh cerebral performance category:

- 1) Good recovery
- 2) Moderate disability
- 3) Severe disability
- 4) Vegetative state
- 5) Death

Patients with 1 or 2 had “favorable” outcome and sufficient cerebral function to live independently and work at least part time.

HACA Study

(NEJM 2002;346:549-56)



Australian Hypothermia Study

(NEJM 2002;346:557-63)

- 77 patients randomized with initial rhythm of VF at time of ambulance arrival
- Primary outcome: “survival to hospital discharge with sufficiently good neurologic function to be discharged to home or a rehabilitation facility.”

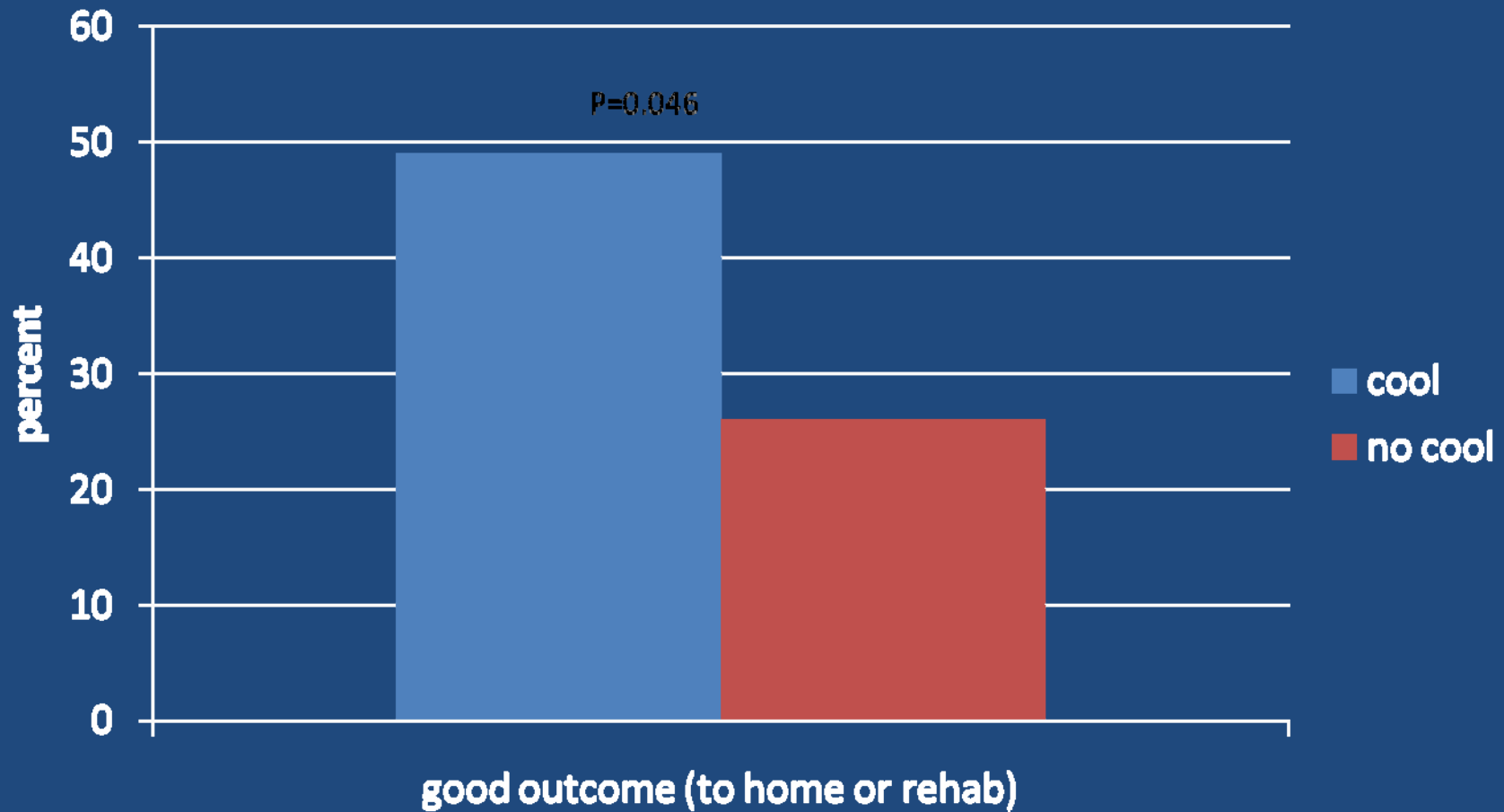
Australian Hypothermia Study

(NEJM 2002;346:557-63)

Outcome	Hypothermia (43)	Normothermia (34)
Normal or minimal disability (self care, discharge to home)	15	7
Moderate disability (discharged to rehab)	6	2
Severe disability (awake-completely dependent)	0	1
Severe disability (unconscious)	0	1
Death	22	23

Australian Hypothermia Study

(NEJM 2002;346:557-63)



HACA - what we don't know

- How widely applicable is HACA (just VT and VF or PEA and asystole)?
- How fast to cool?
- How low to cool?
- How long to cool?
- How fast to warm?

Therapeutic Hypothermia Enrollment Checklist

Date/Time
Your Name

Patient Name
Patient MR#

Inclusion Criteria (must meet all):

- Age >17
- No sedation impairing mental status evaluation
- GCS < 9
- MAP > 60 mm Hg (within 30 min. of arrival)

Exclusion Criteria (must have none):

- Persistent arrhythmias or hemodynamic instability
- Pregnancy
- DNR/DNI
- CPR > 60 minutes
- Major surgery within 14 days
- Active Bleeding
- Pre-arrest symptoms of severe infection or sepsis
- Suspected *traumatic* head injury (only indication for head CT)
- ROSC > 8 hours

Neurologic Exam:

Eye Opening:

- 4. Spontaneous
- 3. To Voice
- 2. To Pain
- 1. None

Verbal:

- 5. Oriented
- 4. Confused
- 3. Inappropriate Words
- 2. Inappropriate Sounds
- 1. None or intubated

Motor:

- 6. Obeys commands
- 5. Localizes to pain
- 4. Withdraws to pain
- 3. Decorticate response
- 2. Decerebrate response
- 1. None

Overall GCS

Initial EMS Rhythm:

- Vtach
- Vfib
- PEA
- Asystole

Initial ED ECG (after ROSC):

- STEMI
- LBBB
- Ischemic ST Depression
- Other

Estimated Arrest to ROSC time (min) CPR Time (min) Explain:

Enrollment Checklist:

Nonpharmacologic Management:

- HACA orderset
- 2L Cold Normal Saline by peripheral IV
- Ice to groin, axilla, neck
- Apply cooling device

Pharmacologic Management:

- Tylenol 1g PR
- Sedation: Propofol (17mcg/kg/min)
- Analgesia: Fentanyl (50-100mcg bolus, 50mcg/hour)
- Paralysis: Rocuronium (600mcg/kg IV bolus 4-16 mcg/kg/min infusion) OR Atracurium (0.5mg/kg bolus, 5-9 mcg.kg.min infusion)

Lines & Catheters:

- Central Venous Access
- Foley
- Temperature Probe
- OG Tube

Disposition:

Contact CCU or MICU Fellow to Facilitate Treatment Disposition: MICU Fellow (45771) CCU Fellow (623-9119)

CCU Admission:

- STEMI
- Vfib/Vtach Arrest
- Clinical Presentation consistent with ACS

MICU Admission:

- PEA Arrest
- Asystole Arrest

Time

Excluded?
Please
explain

Conclusion

- Outcome after cardiac arrest is poor.
- HACCA may be beneficial in certain groups of patients.
- HACCA does not appear to be harmful.