

Therapeutic Hypothermia

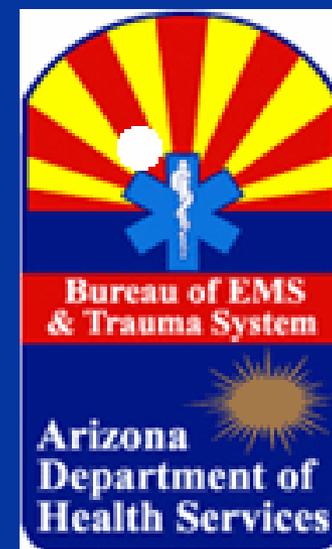
We Restored a Perfusing Rhythm!

Now Do We Start Hypothermia? How?

Ben Bobrow, MD

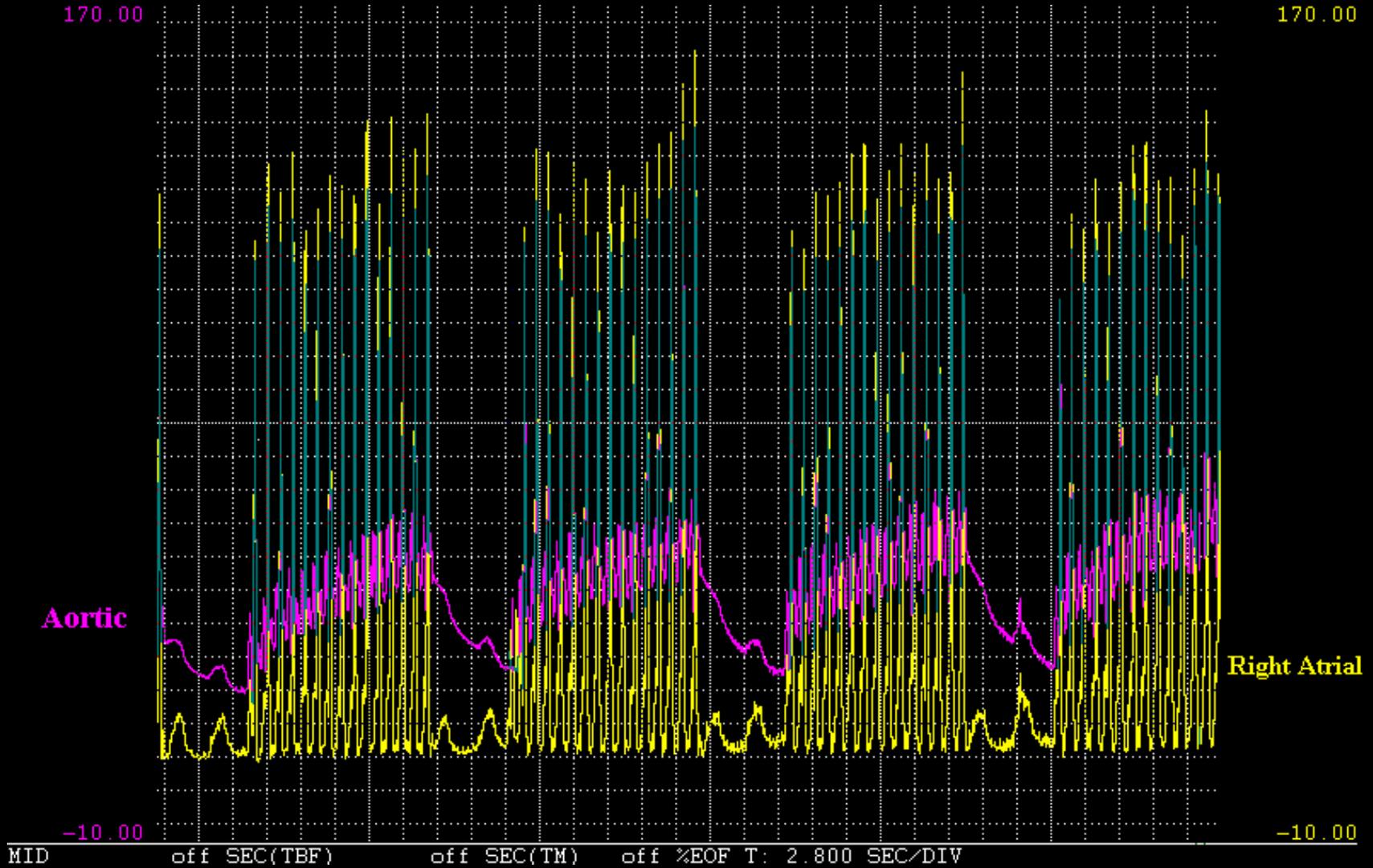
Medical Director

Bureau of EMS & Trauma System



Discussion

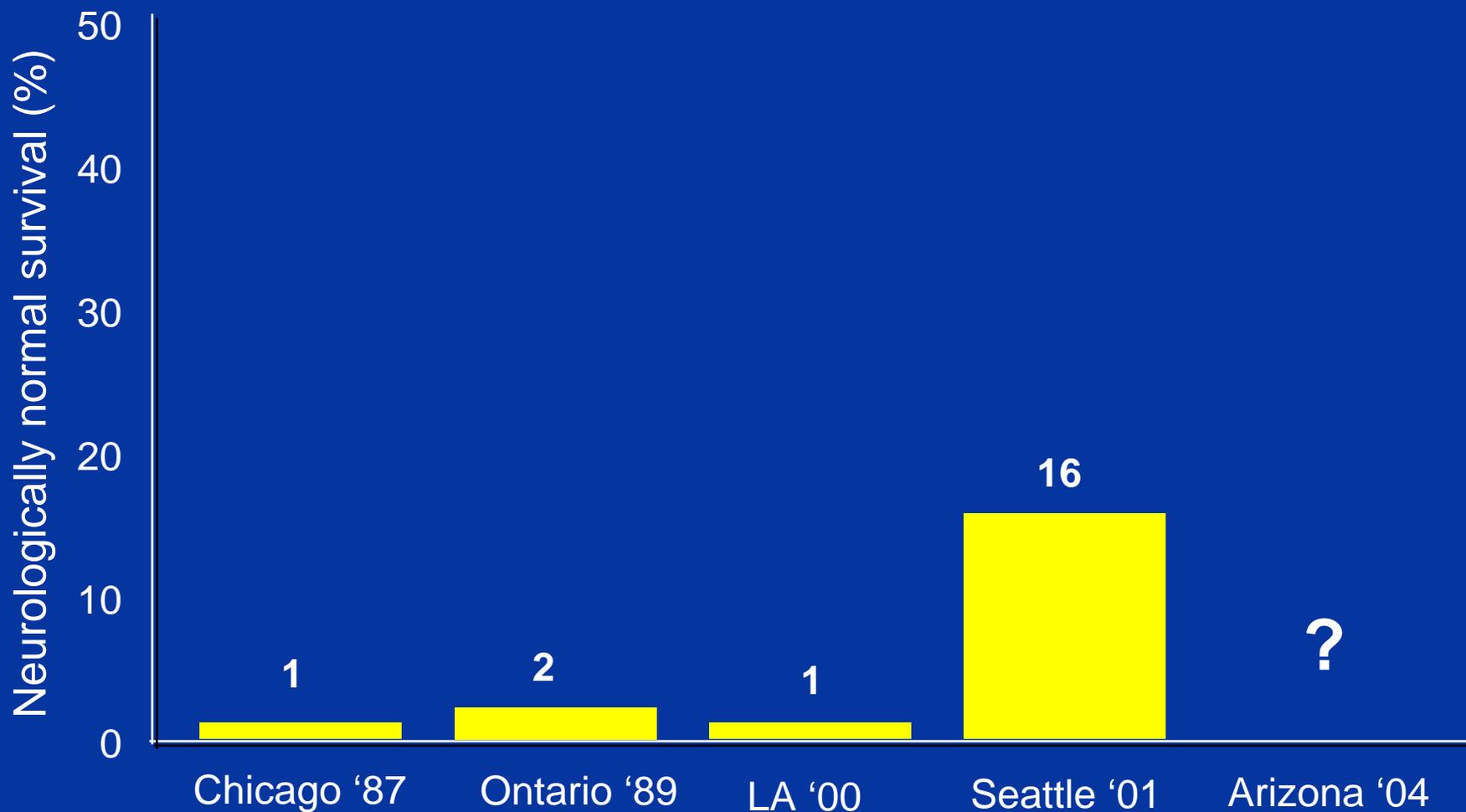
Standard CPR 15:2



Coronary Perfusion pressure (Ao diastolic- RA diastolic)



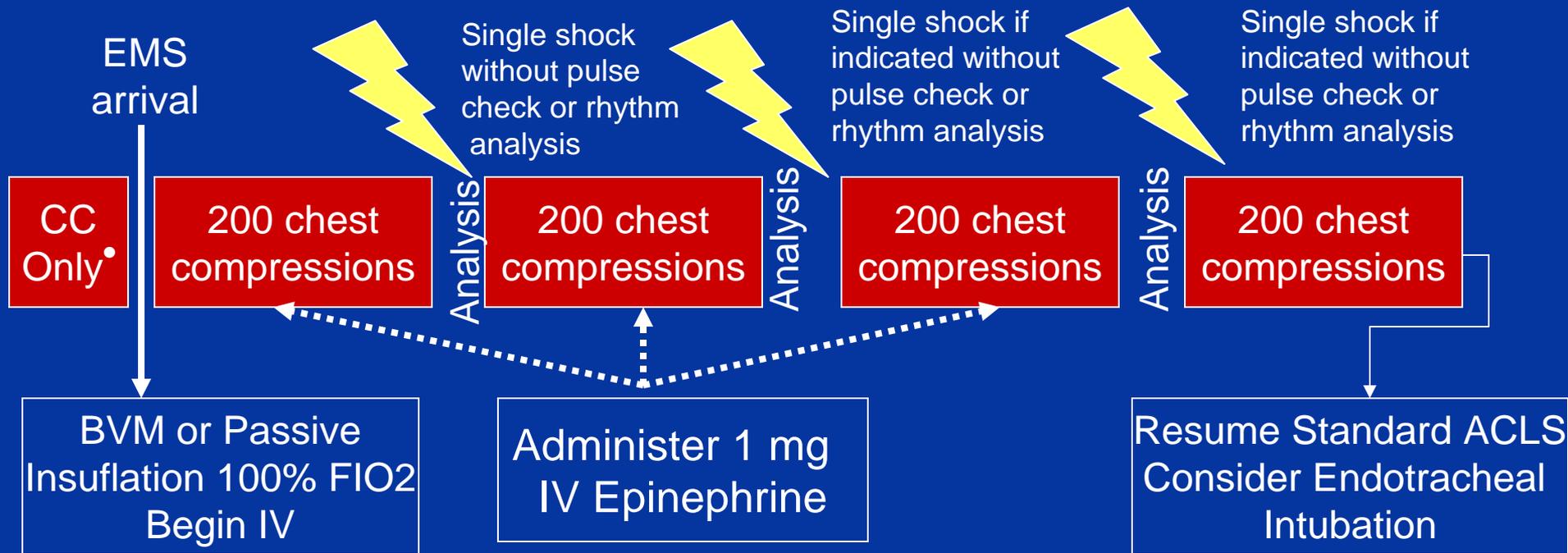
OHCA Survival



Eckstein M et al. *Annals of Emerg Med.* 2005;45: Issue 5;504-509

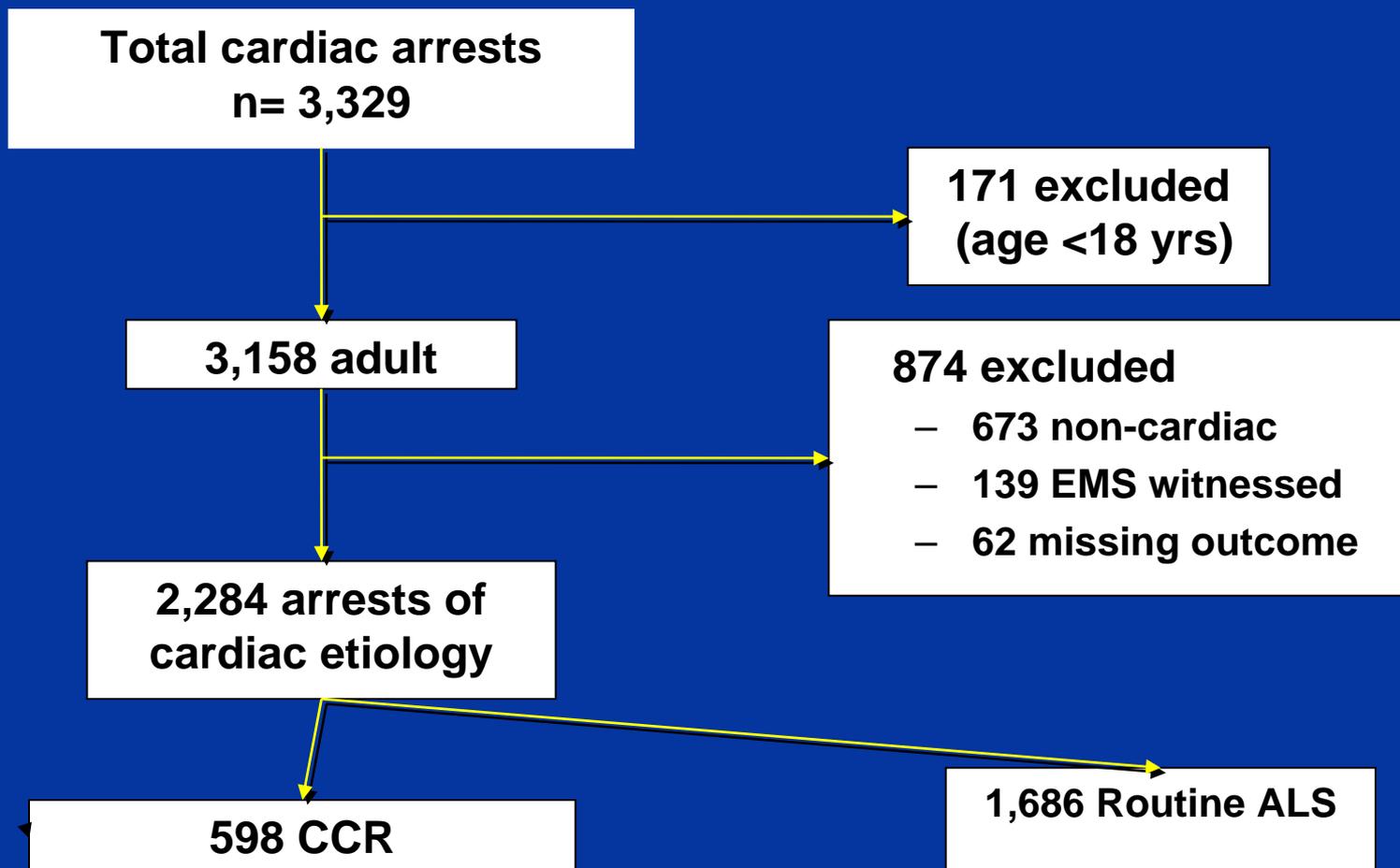
Rea T et al. *Circulation.* 2003;107:2780-2785

Cardiocerebral Resuscitation (CCR)



- If adequate bystander chest compressions are provided, EMS providers perform immediate rhythm analysis

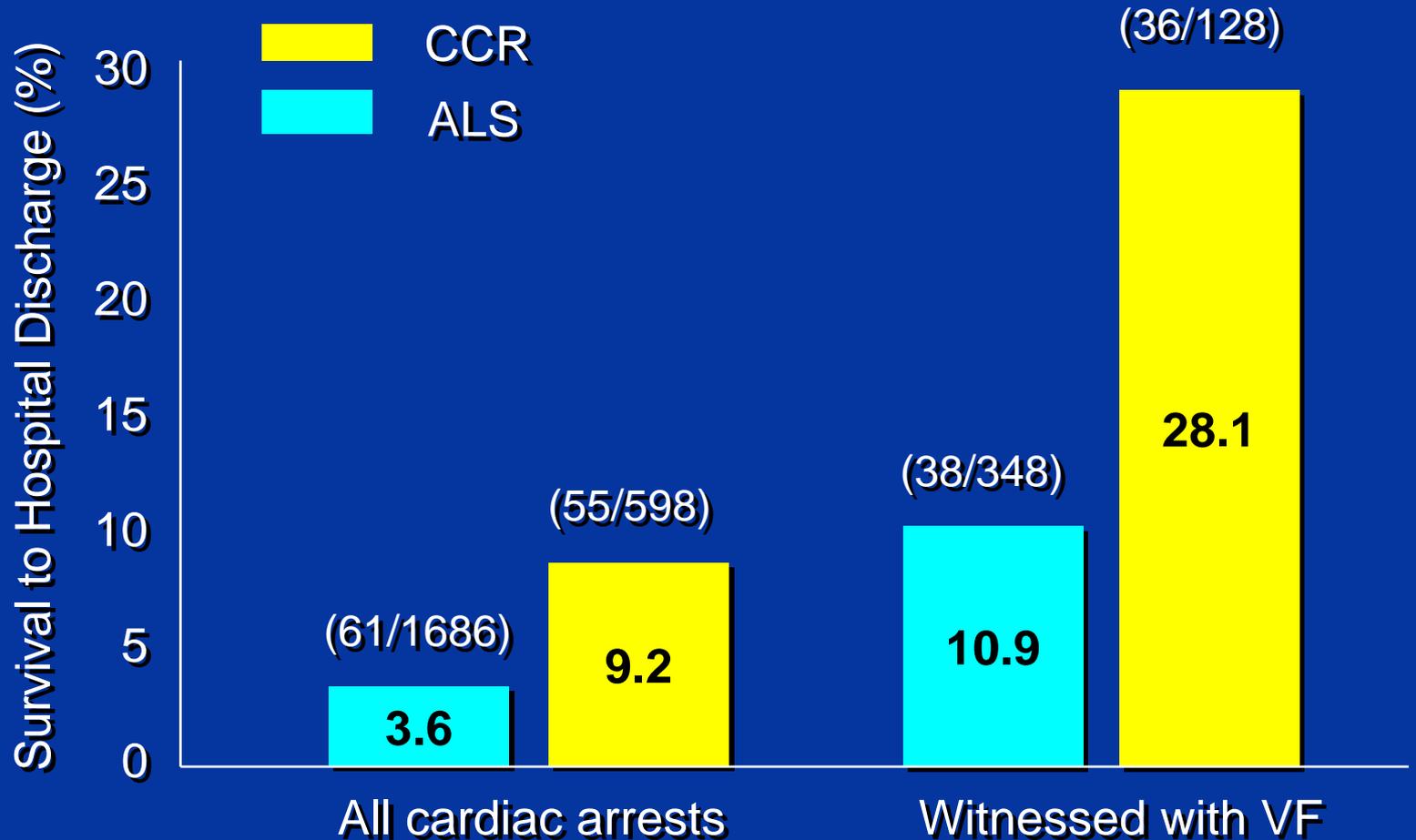
Enrollment





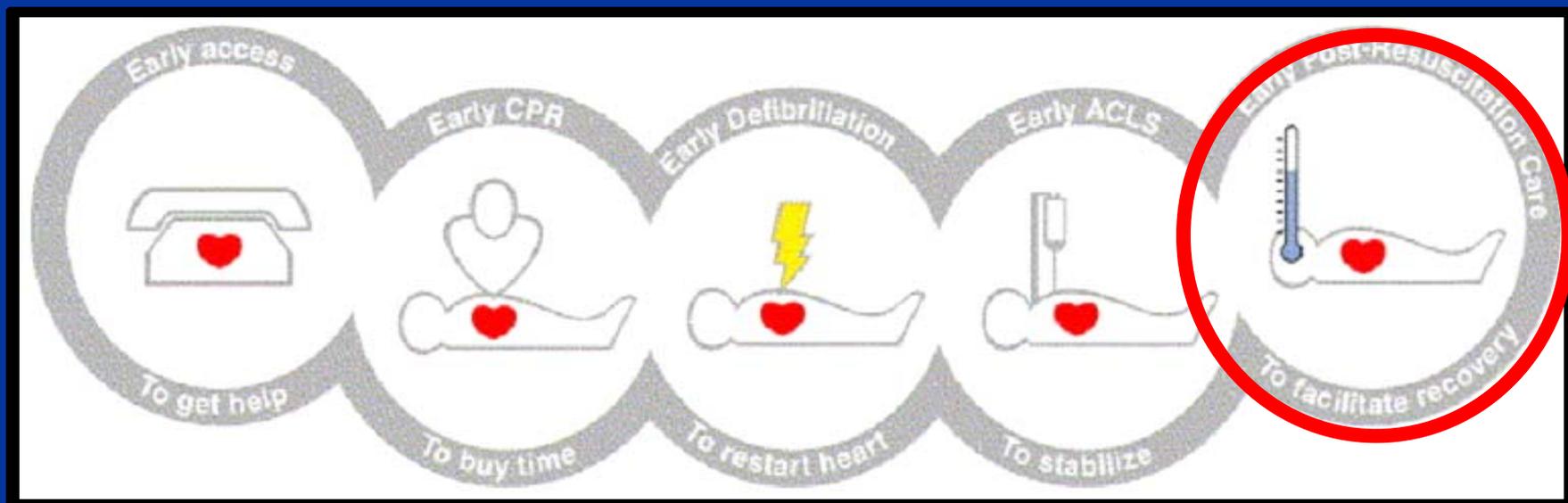
Results

Survival from Out of Hospital Cardiac Arrest



HOW DO WE IMPROVE SURVIVAL?

Therapeutic Hypothermia



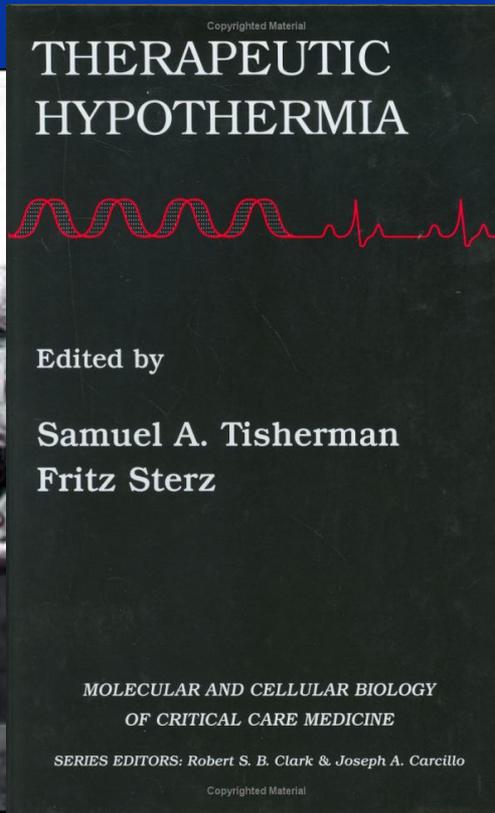
An AHA ECC Impact Goal: Double Survival from Cardiac Arrest by 2010

The data presented in this session suggests that with the broad implementation of the Sarver Heart Center's **Cardiocerebral Resuscitation** program for cardiac arrest, we can exceed the goal now

Clinical Hypothermia History

450 B.C.
1814

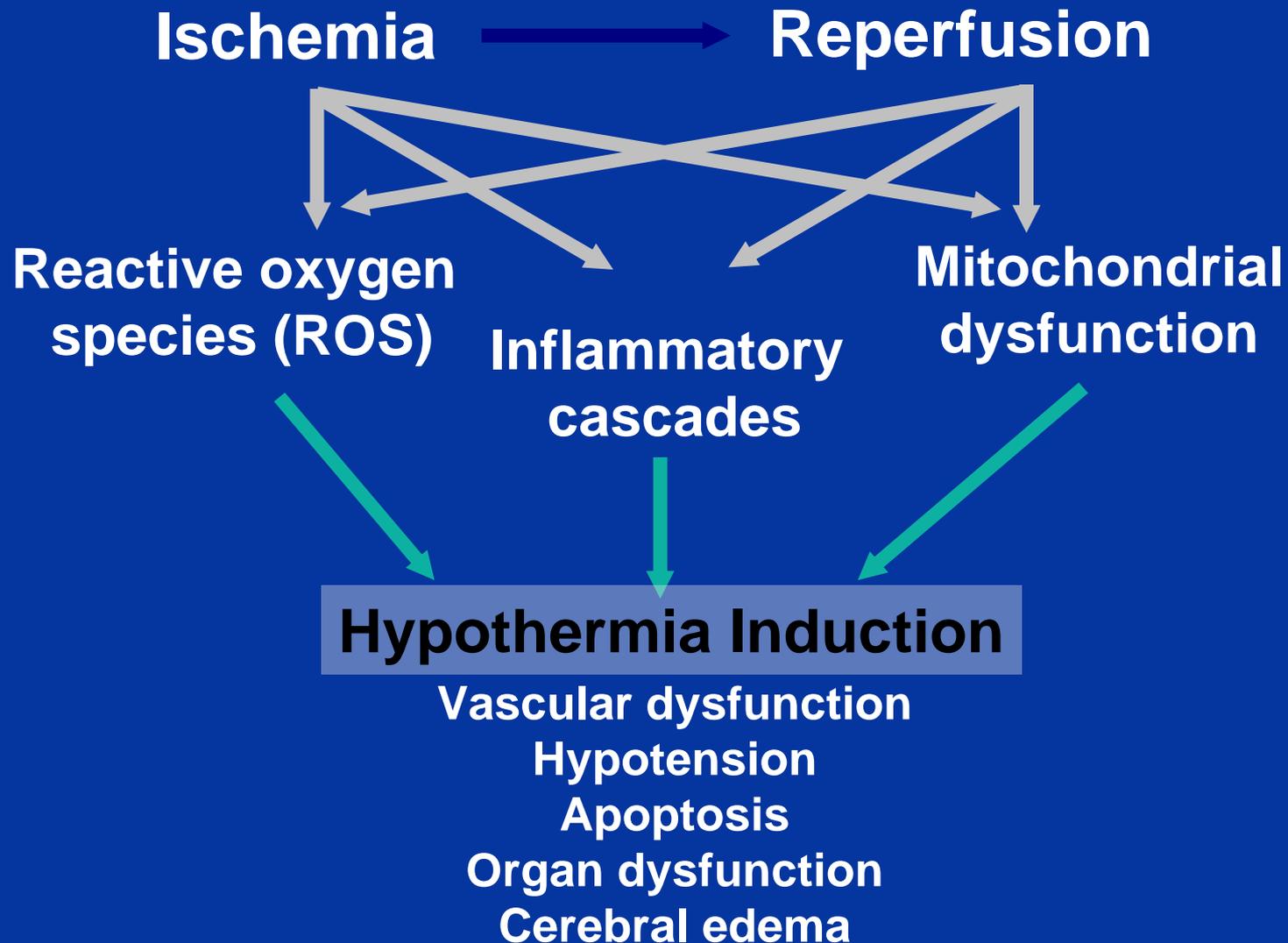
The use of hypothermia for brain injury is a modern concept, but hypothermia has been used as a therapy through the Nazi era and to the present day for cardiac arrest experiments and organ donation.



Reperfusion Injury

- Reperfusion injury is defined as *“damage observed after restoration of blood flow to ischemic tissues”*
- There are three potential treatment modalities to counteract the untoward effects of reperfusion:
 - Increased ICU care and length of stay
 - Antioxidants
 - Hypothermia induction

Reperfusion Injury



Clinical Hypothermia

Mechanism of Action

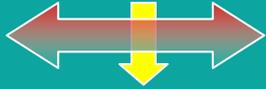
- **There are three distinct stages of cerebral injury after hypoxic insult**
 - Early
 - Intermediate
 - Late
- **Therapeutic hypothermia is considered to be neuroprotective by acting at each of the three stages of injury**

Early Stage

Cardiac Arrest



Cerebral blood flow decreases



Metabolic demand increases

(Oxygen, adenosine, triphosphate, glucose)

Demand

Demand

Supply

Supply

Clinical Hypothermia

Mechanism of Action

- In this stage, hypothermia immediately decreases energy utilization, consumption of oxygen, and glucose despite ongoing consumption of oxygen, adenosine triphosphate and glucose



Recent Studies

The New England Journal of Medicine

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VOLUME 346

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NUMBER 8

INDUCED HYPOTHERMIA AFTER OUT-OF-HOSPITAL CARDIAC ARREST



Resuscitation 51 (2001) 275–281

RESUSCITATION

Mild hypothermia induced by a helmet device:
a clinical feasibility study

Normothermic

Hypothermic

Said Hachimi-Idrissi *, Luc Corne, Guy Ebinger, Yvette Michotte, Luc Huyghens

Alive at 6 months
with favorable
neurologic status

53% (75/136)

35% (54/137)

Department of Critical Care Medicine and Resuscitation, School of Nursing, AZ-VUB, Free University of Brussels, Laarbeeklaan, 101, B-1090, Brussels, Belgium



The New England Journal of Medicine

Established in 1812 as THE NEW ENGLAND JOURNAL OF MEDICINE AND SURGERY

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Mild Therapeutic Hypothermia to Improve the Neurologic Outcome After Cardiac Arrest (HACA)

- Patients with witnessed cardiac arrest from VF or pulseless VT, 18-75 years of age, estimated 5-15 minutes to attempted resuscitation, and less than 60 minutes from collapse to restoration of spontaneous circulation
- 275 patients of 3,551 cardiac arrests studied
- 137 patients received hypothermia

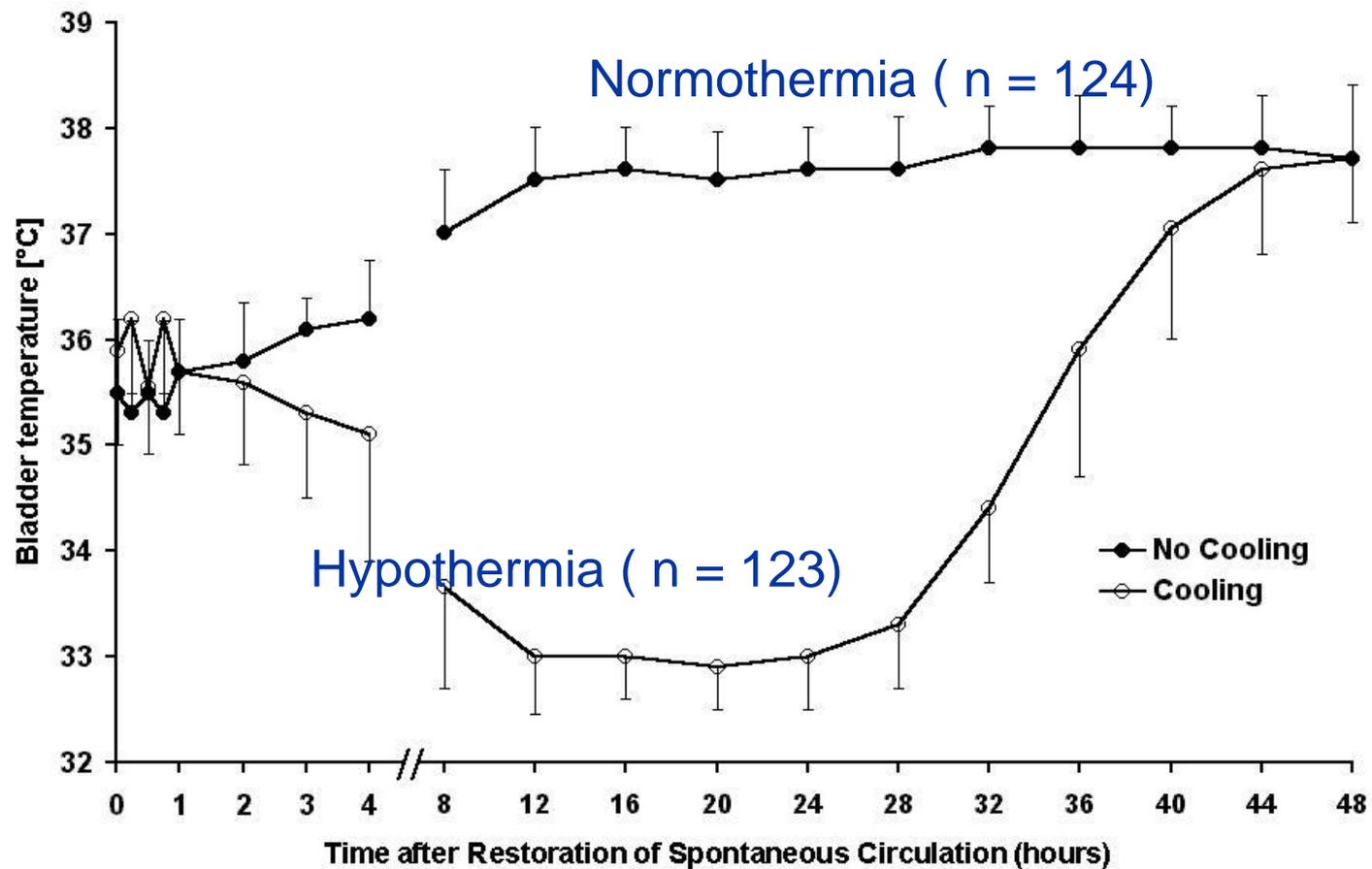
Dr. Fritz Sterz, Vienna, Austria, and The Hypothermia After Cardiac Arrest Study Group, *N Engl J Med* 2002; 346:549-556

Mild Therapeutic Hypothermia to Improve the Neurologic Outcome After Cardiac Arrest (HACA)

- Sedation: I.V. midazolam (Versed) 0.125 mg/kg/hr initially
- Sedation: I.V. fentanyl (Sublimaze) 0.002 mg/kg/hr initially
- To prevent shivering: I.V. pancuronium (Pavulon) 0.1 mg/kg every 2 hours for 32 hours

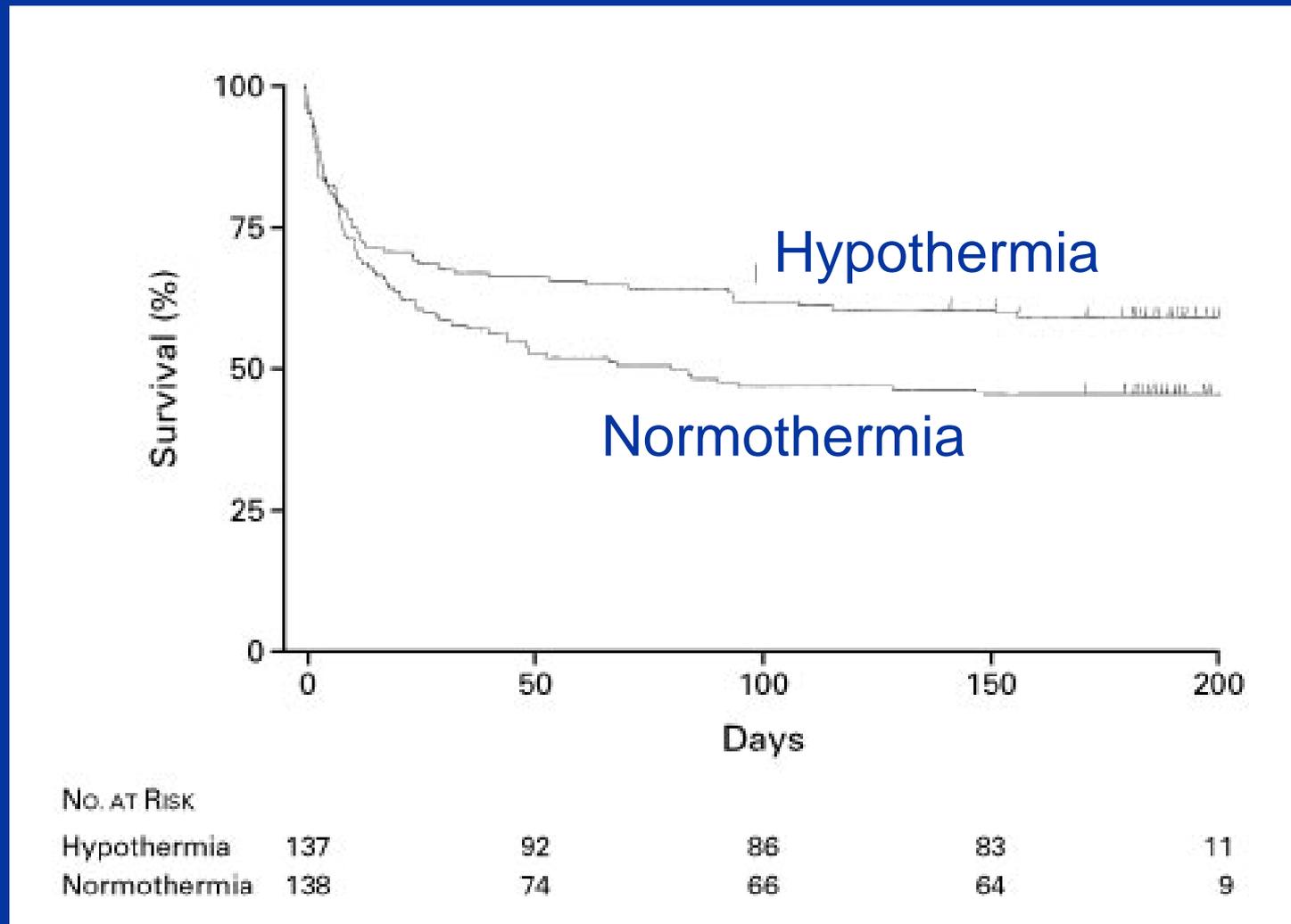
Dr. Fritz Sterz, Vienna, Austria, and The Hypothermia After Cardiac Arrest Study Group, *N Engl J Med* 2002; 346:549-556

Bladder Temperature Course

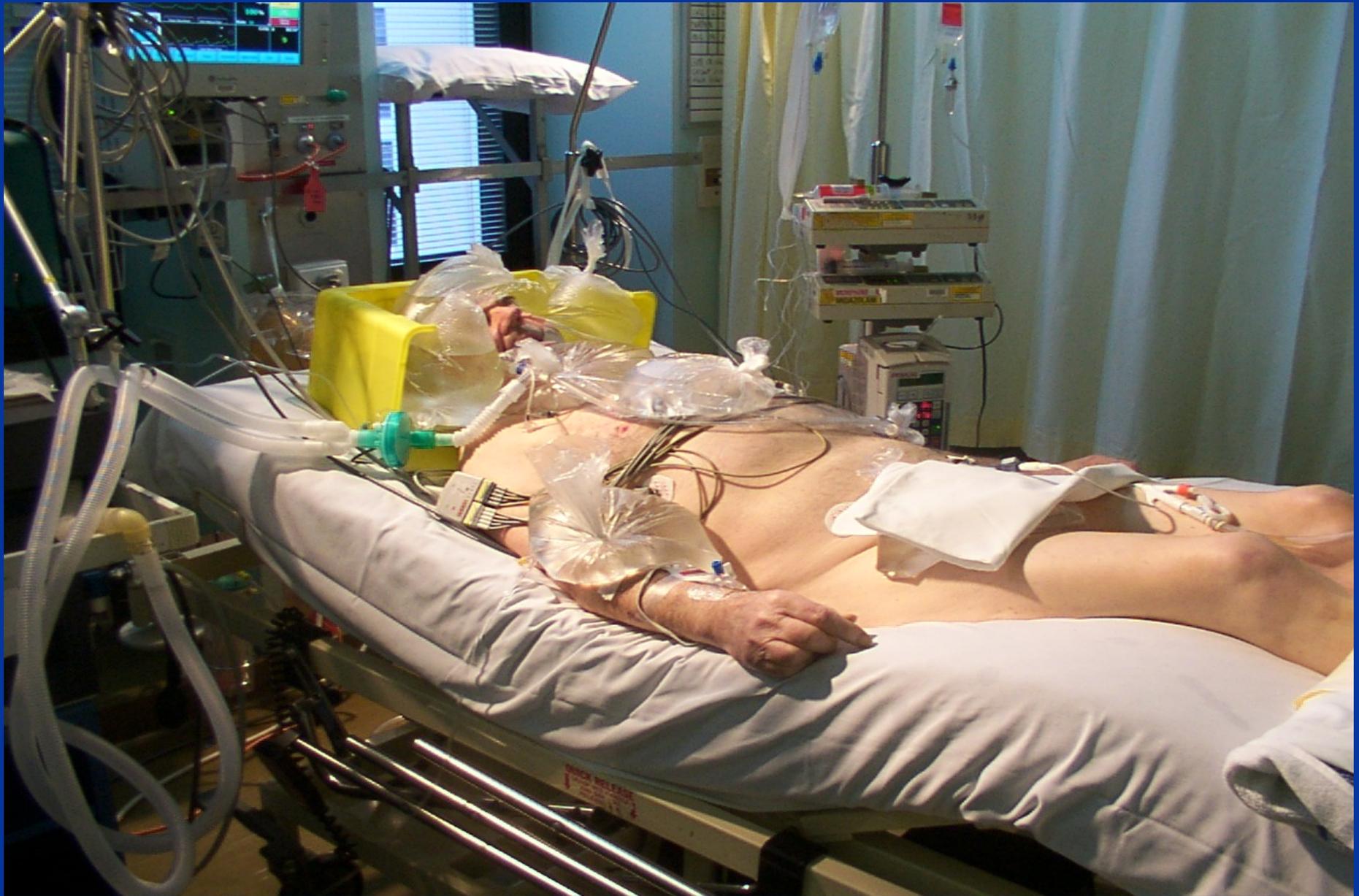


Dr. Fritz Sterz, Vienna, Austria and The Hypothermia After Cardiac Arrest Study Group, *N Engl J Med* 2002; 346:549-556

Hypothermia for Coma After Cardiac Arrest



Dr. Fritz Sterz, Vienna, Austria and The Hypothermia After Cardiac Arrest Study Group, *N Engl J Med* 2002; 346:549-556

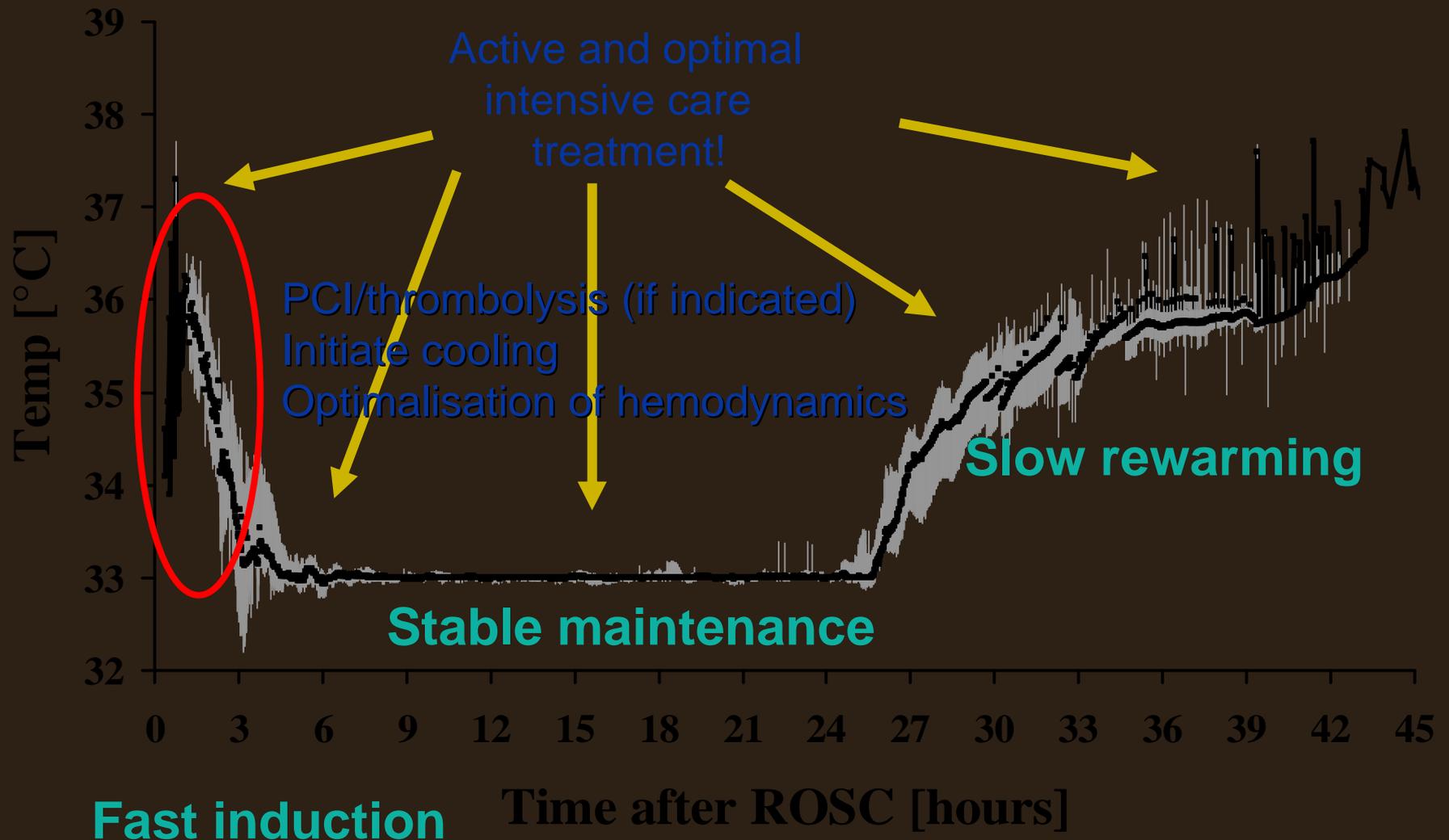


Recommendations

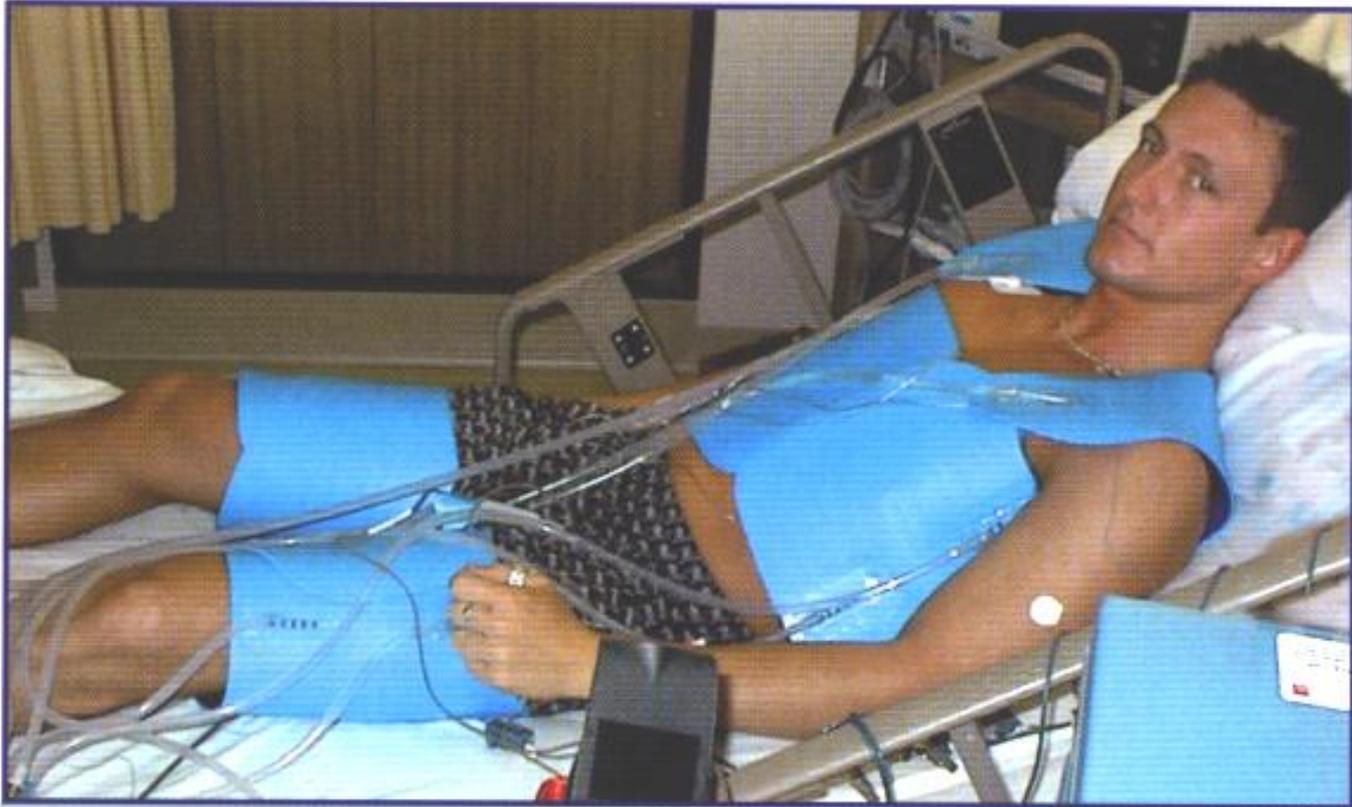
- Unconscious adult patients with return of spontaneous circulation (ROSC) after out-of-hospital cardiac arrest should be cooled to 32°C to 34°C (89.6°F to 93.2°F) for 12 to 24 hours when the initial rhythm was ventricular fibrillation. *Class IIa*
- Similar therapy may be beneficial for patients with non-VF arrest out of hospital or for in-hospital arrest. *Class IIb*



Optimal treatment during reperfusion



Medivance “Arctic Sun”

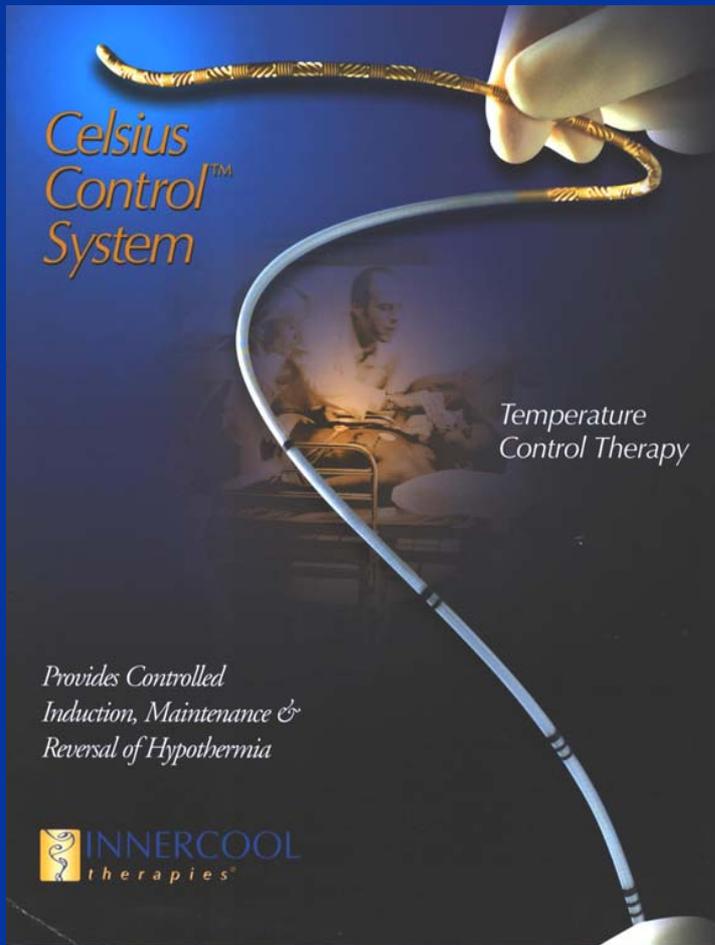


Arctic Sun Energy Transfer Pads

The LRS ThermoSuit[®] System



Endovascular Hypothermia



- Celsius Control™ System
- Placed in IVC
- Does not infuse fluid into the patient, nor is blood circulated outside of the body
- INNERCOOL Therapies

Treatment of Comatose Survivors of Out-Of-Hospital Cardiac Arrest with Induced Hypothermia (Bernard)

Cooling Device



What could EMS offer the pt?

- 22 pts post ROSC who remained comatose
- 30ml/kg of ice-cold saline given via peripheral IV or femoral central line over 30 min after patient evaluated and paralyzed
- Decreased core temp from 35.5 to 33.8°C



Induced hypothermia using large volume, ice-cold intravenous fluid in comatose survivors of out-of-hospital cardiac arrest: a preliminary report

Stephen Bernard ^{a,b,*}, Michael Buist ^a, Orlando Monteiro ^a, Karen Smith ^b

^a *The Intensive Care Unit, Dandenong Hospital, David St, Dandenong, Victoria 3175, Australia*

^b *Department of Epidemiology and Preventive Medicine, Monash University, St Kilda Rd, Prahran 3181, Victoria, Australia*

Received 1 July 2002; accepted 26 July 2002



*Bernard SA, et al. Resuscitation 2003;
56:9-13*

Scottsdale Fire Department

Cardiac Arrest Center

Destination Protocol

Purpose:

To improve the chance of good neurologic outcome from out-of-hospital cardiac arrest (OOHCA) by selectively transporting patients who have return of spontaneous circulation (ROSC) to Regional Cardiac Arrest Centers where they will receive specialized care (therapeutic hypothermia and potential cardiac catheterization).

Inclusion Criteria for Selective Bypass:

When feasible, prehospital providers will selectively transport adult patients (age 18 and older) who have ROSC post cardiac arrest to the nearest Cardiac Arrest Center if the following criteria are met:

Palpable pulse or other evidence of spontaneous circulation after non-traumatic OOHCA

Comatose after ROSC, GCS < 8, no purposeful movement

Less than 30 minutes of CPR performed prior to EMS arrival

Transportation to a Cardiac Arrest Center is expected to add less than 15 minutes to the transport interval

No DNR paperwork identified

Post Cardiac Arrest Care:

EMS personnel will give pre-arrival notification of OOHCA patient

Do NOT actively warm patients in the field

Consider 500ml NS IV fluid bolus

Consider Lidocaine bolus and drip based on patient weight

Maintain ventilation rate of 8 breaths/minute

OOHCA patients who remain comatose after ROSC will be taken to the closest available Cardiac Arrest Center when feasible and all inclusion criteria are met.

Cardiac Arrest Centers:

Cardiac Arrest Centers will be designated based upon their ability to deliver therapeutic hypothermia and 24/7 cardiac catheterization.

Safety Evaluation of a Prehospital Cardiac Arrest Regionalization Protocol for Patients with Return of Spontaneous Circulation in the Field

OBJECTIVE: There is good evidence that therapeutic hypothermia (TH) improves neurological outcomes for prehospital cardiac arrest (PCA). Yet, TH is used in less than 10% of hospitals for comatose survivors of cardiac arrest. Regionalizing post-resuscitation care for PCA patients with return of spontaneous circulation (ROSC) to facilities that provide TH might increase the rate of neurologically intact survivors. We applied a theoretical prehospital bypass protocol to our statewide PCA database to assess the safety of potentially bypassing the closest hospital with comatose, ROSC patients and transporting them to a designated regional cardiac arrest center (RCAC).

METHODS: Data from an Utstein style-compliant registry of PCA patients that captures approximately 70% of Arizona's population were evaluated (October, 2004-December, 2006). We evaluated the association between EMS transport interval (TI-depart scene to ED arrival) and survival to hospital discharge in all adult, non-traumatic PCA patients and in the subgroup of patients who achieved ROSC but remained comatose.

RESULTS:

1846 PCAs were adult, of cardiac etiology and with the arrest occurring prior to EMS arrival. Complete TI data were available for 1177 PCAs with 70 (5.9%) surviving to hospital discharge. 253/1177 (21.5 %) achieved ROSC and remained comatose (meeting criteria for bypass protocol) with 43 (17.0%) surviving. Mean TI for all PCAs was 6.9 minutes (95% CI: 6.7, 7.1). Logistic regression revealed multiple factors that were strongly associated with survival: Witnessed arrests, bystander CPR, and decreased EMS response interval (dispatch to scene arrival). This analysis, after controlling for confounding factors, revealed no significant association between TI and survival (odds ratio 1.2, 95% CI 0.7-1.8). Similar results were found for the comatose, ROSC sub-group (OR 1.0, 95% CI 0.5-1.9).

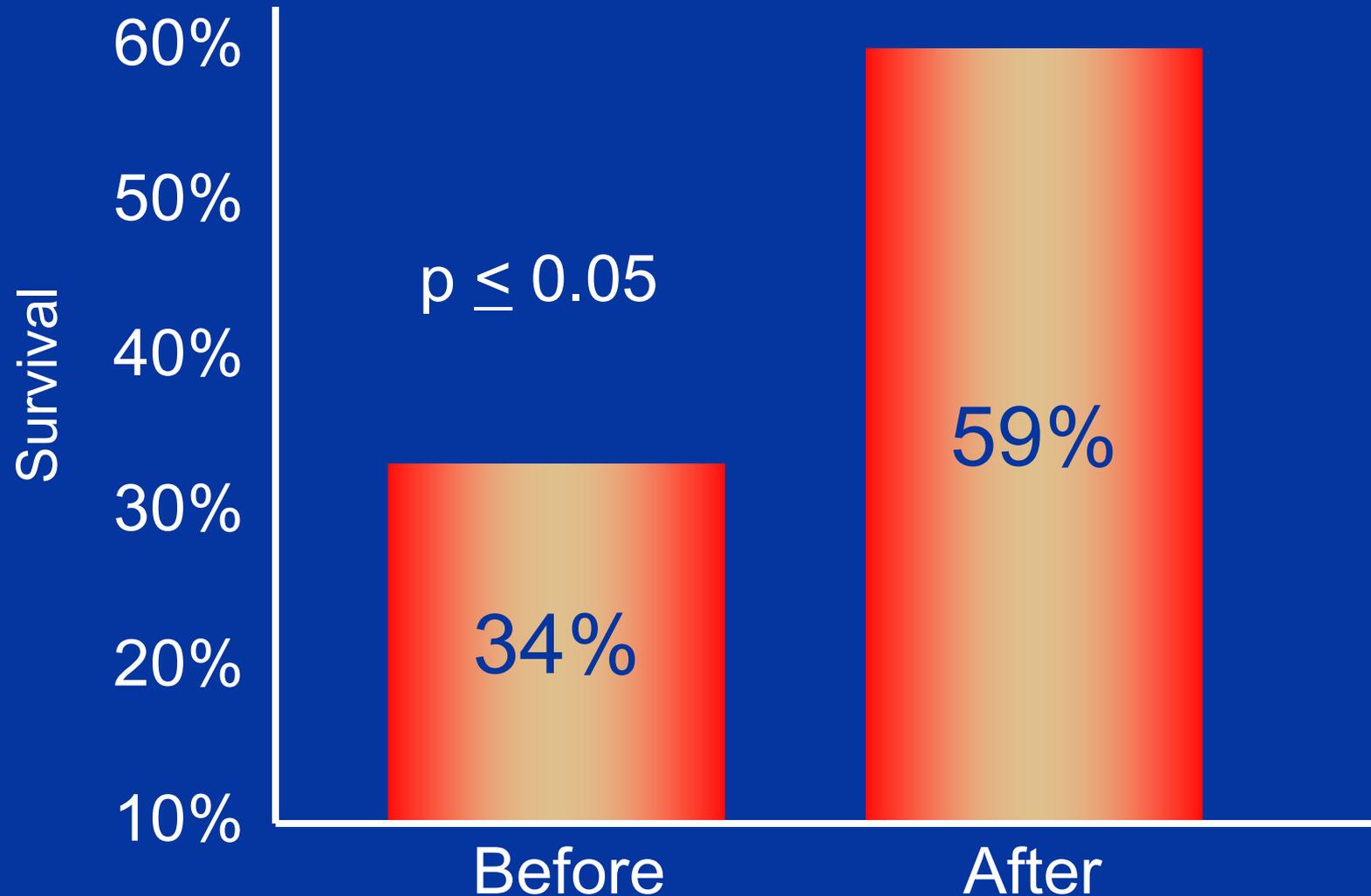
CONCLUSION: In our statewide database, survival of adult PCA patients did not significantly decrease with an increase of the TI. This suggests that a modest increase in TI due to bypassing the closest hospital to transport eligible patients to a RCAC is safe and warrants further investigation.

Post Resuscitation Care

Oslo, Norway Experience

- Found that only 34% of patients initially resuscitated and delivered to the ED survived to discharge
- They Formalized an approach to post-resuscitation care:
 - Therapeutic Hypothermia
 - PCI when indicated
 - Ventilation Control
 - Glucose Control
 - Hemodynamic Control

Aggressive Post Resuscitation Care Saves Lives



Pytte M, Jensen LP, Smedsrud C, Jacobsen D, Mangschau A, Sunde K.
Oslo, Norway

Prehospital Cooling

Hypothermia post-cardiac arrest

- Use of ice cold Ringer's soln pre-hospital for comatose pts post arrest
 - Pts given 30cc/Kg at rate of 100 ml/min
 - Air ambulance with 25 min infusion
 - Pts reached target temp of 34 C with arrival to ED
-
- Resuscitation 2004:62:299-302

SFD - Cardiac Arrest Center Destination Protocol

Inclusion Criteria for Selective Bypass:

- Age 18 and older
- ROSC post VF cardiac arrest
- Palpable pulse or other evidence of spontaneous circulation
- Non-traumatic OOHCA
- Comatose after ROSC, GCS < 8, no purposeful movement
- Transportation to a Cardiac Arrest Center is expected to add less than 15 minutes to the transport interval
- No DNR paperwork identified

Post Cardiac Arrest Care:

Give pre-arrival notification of OOHCA patient

Do NOT actively warm patients in the field

Administer - 500ml NS IV fluid bolus

Consider Lidocaine bolus and drip based on patient weight

Maintain ventilation rate of 8 breaths/minute

Cardiac Arrest Centers:

Cardiac Arrest Centers will be designated based upon their ability to deliver therapeutic hypothermia and 24/7 cardiac catheterization.



UNIVERSITY MEDICAL CENTER
Tucson, Arizona 85724



HYPOTHERMIA POST CARDIAC ARREST

Page 1 of 2

MEDICAL CENTER
DOB
NAME
POSTER

Chief Complaint (CC):
Reason for test or
service: ICD-9 codable)

ALLERGIES: (DRUG, FOOD, ENVIRONMENTAL)
 NO KNOWN DRUG ALLERGIES

NO KNOWN FOOD ALLERGIES

NO KNOWN ENVIRONMENTAL ALLERGIES
Wt: _____

ARTIC SUN HYPOTHERMIA DEVICE

Attending Physician: _____

PATIENT INCLUSION CRITERIA:

- Resuscitated cardiac arrest > 18 years of age
 - Comatose (GCS <8) after return of spontaneous circulation
 - Endotracheal intubation with mechanical ventilation
 - Mean Arterial Pressure > 60mm Hg with or without vasopressors and volume
- Note: Adequate sedation and analgesia and paralytics are required for Artic Sun study

ORDERS

- Insert Foley urinary catheter with temperature probe
- Vital Signs - Record heart rate, blood pressure, cardiac rhythm and Foley and secondary (Tympanic / Esophageal / Rectal) temperature at 15 minute intervals during active cooling, 30 minutes intervals during the first 2 hours of hypothermia maintenance and one hour intervals during maintenance, record temperatures at 30 minutes intervals during active rewarming
- Maintain target temperature at 33.5 degrees C for 24 hours
- Check skin integrity every 8 hours
- Cooling method, Artic Sun Hypothermia Device
 - USE ARTIC SUN HYPOTHERMIA DEVICE
 - If time permits, turn the Artic Sun to the ON position.
 - Press Manual Mode to begin pre-cooling the water to 4° C
 - Place the Artic Sun Energy Transfer Pads. Ensure that all pads in a kit are used to cover the back, abdomen, and thighs
 - Connect the Artic Sun Energy Transfer Pads to the fluid delivery line from the Artic Sun. Connect the Foley catheter to the Artic Sun temperature cable.
 - Press Automatic Mode. Confirm the Patient Target Temperature displayed on the screen is set to 33.5° C
 - Press the down arrow to the Patient Target Temperature Screen and follow the directions to change Patient Target Temperature to 36° C
 - Press the down arrow to the Patient Target Temperature to 0.25° or 3° C/hour. Corresponding hours will be shown on the display screen.
 - Press the down arrow to the Patient Target Temperature to 0.25° or 3° C/hour. Corresponding hours will be shown on the display screen.
 - Press Automatic to start.

<http://www.med.upenn.edu/resuscitation/Hypothermia.htm>

Physician Signature _____

WHITE - Medical Record

YELLOW - Pharmacy

Date: _____ Time: _____ (Military)

PNW 1.00

THE GOP'S IRAQ REBELLION • MEN IN DRAG, AGAIN

Newsweek

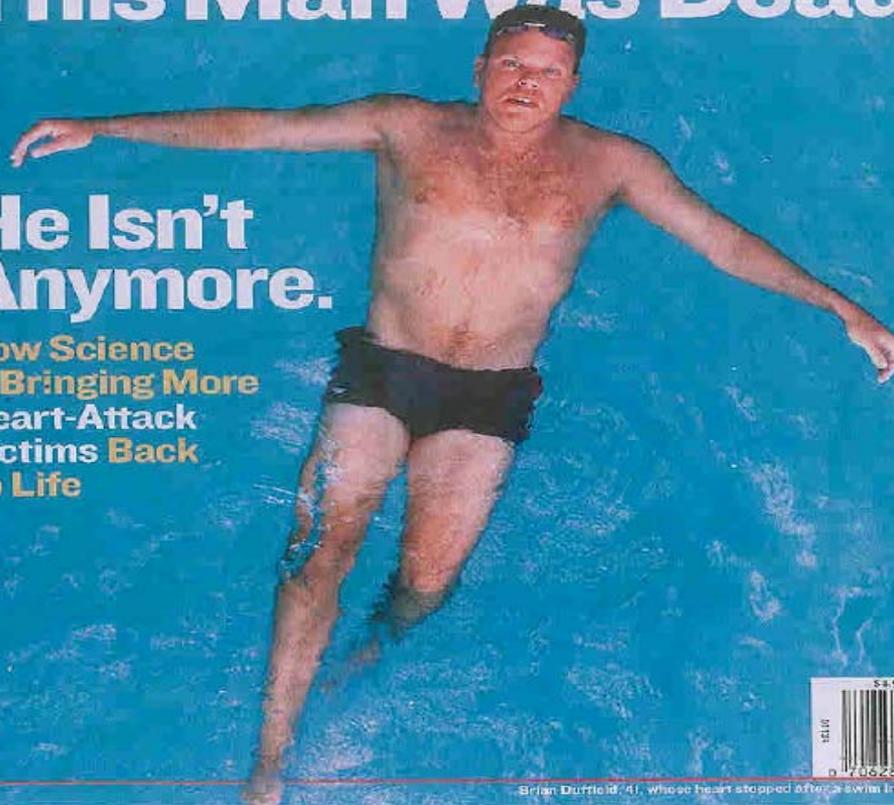
July 23, 2007

newsweek.com

This Man Was Dead.

He Isn't Anymore.

How Science
Is Bringing More
Heart-Attack
Victims Back
To Life



Brian Duffie, 41, whose heart stopped after a swim in May 2006

Hypothermia Patient and family

St. Cloud, Minnesota Spring 2006

Take Heart
America
Sudden Cardiac Arrest Survival Initiative

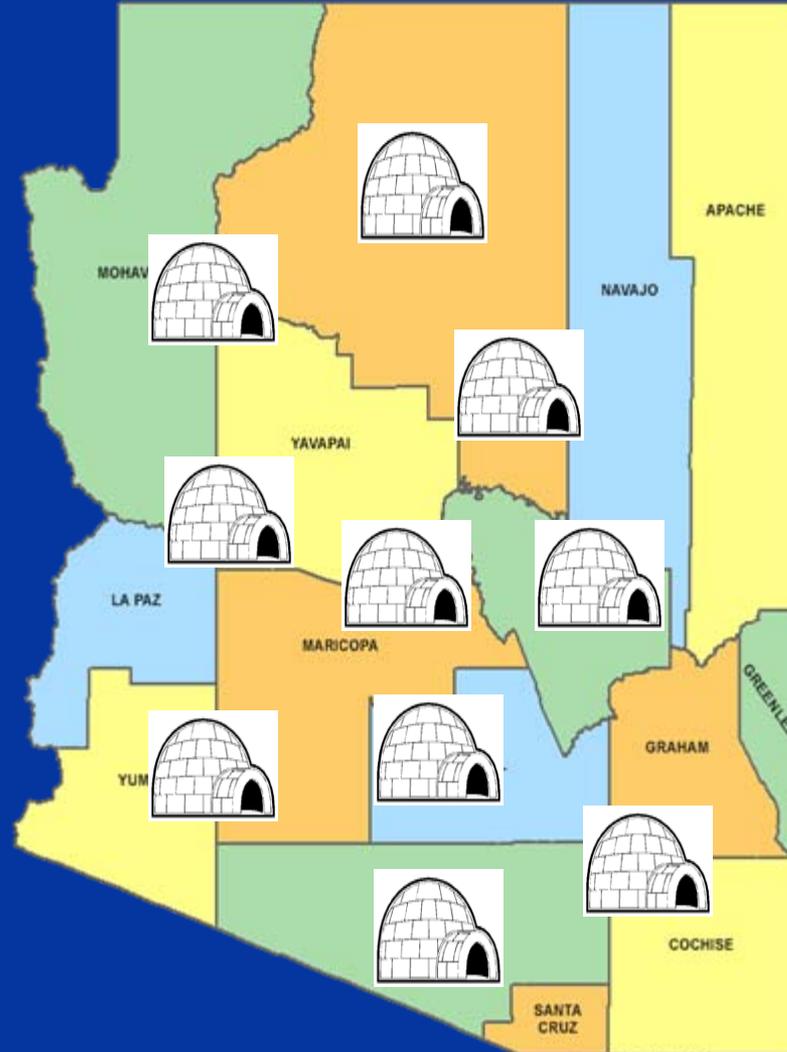


Hypothermia in St. Cloud from Dec '05 to August '07

53 patients with cardiac arrest from all causes cooled: 50% alive and well

24 patients with VF witnessed prehospital arrest: 63% alive and well

Cardiac Arrest Centers Arizona



JUST DO IT!



Bobrowb@azdhs.gov