“Any man’s death diminishes me, because I am involved in mankind…”

- John Donne

Cardiac Arrest in 2011…
Where are we?
Or where should we be?

Michael W. Dailey, MD FACEP
Associate Professor of Emergency Medicine
Albany Medical College

Disclaimers:

I have no conflicts to disclose.

Sports » Olympics

Marathon runner with heart attack recovering

Posted 4h 38m ago | Comment | Recommend
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BOSTON (AP) — A 64-year-old man running in the Boston Marathon had a heart attack and was revived along the side of the course.

Race officials say he is in stable condition at the Beth Israel Deaconess Medical Center in Boston. Authorities would not identify him, but they said he was from out of state.

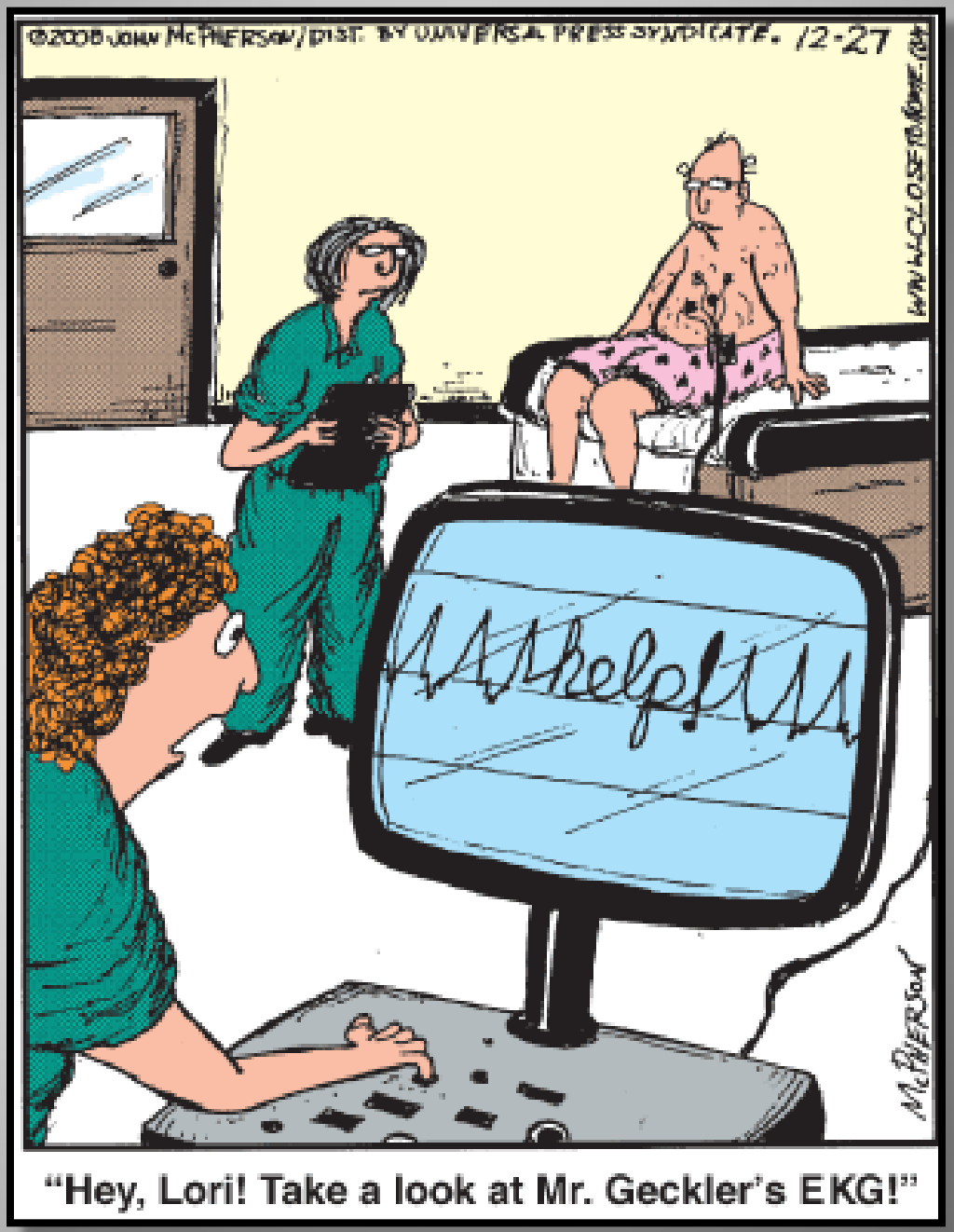
James Hooley, with the Boston EMS, said the man had a heart attack less than two miles from the end of the race. He staggered to the ground, and bystanders helped resuscitate him with chest compressions until first aid workers arrived with a defibrillator.

A total of 1,324 runners in the field of more than 26,000 received first aid of some sort along the route or at the finish. Thirty-three were taken to hospitals for treatment.

REMO

Introduction

- Historical outcomes of comatose cardiac arrest survivors is terrible
- Cardiac Arrest causes the release of toxic compounds directly linked to brain injury
- Therapeutic Hypothermia (TH) reduces the release of toxic compounds, thus reduces brain injury



"Hey, Lori! Take a look at Mr. Geckler's EKG!"

REMO


LIFEPAK 10

Most important point!

- ROSC comes first!
- Good CPR, early defibrillation, controlled ventilations all contribute to increased ROSC
- No breaks in compressions if possible
- Cardiac arrest is won at the scene of the arrest, not in the ambulance or at the hospital—achieve ROSC, then transport*

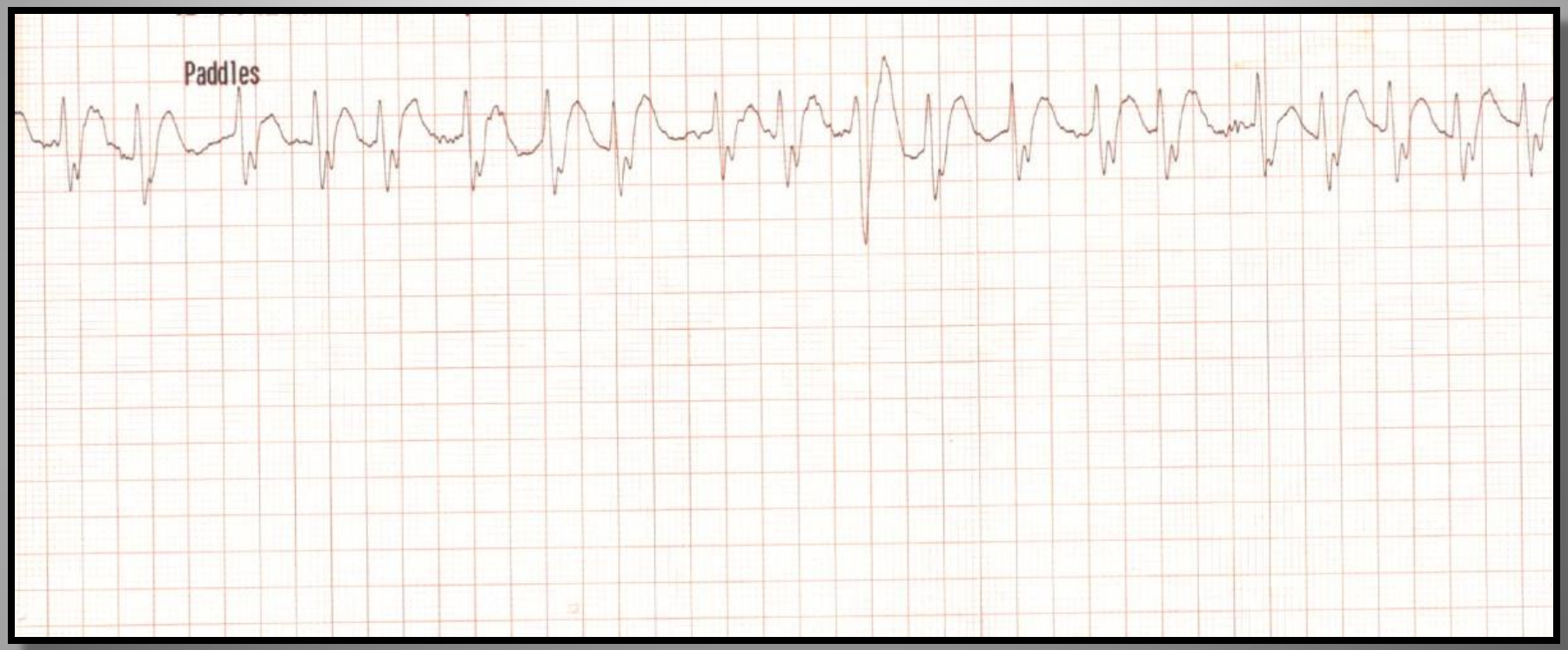
*When safe to do so

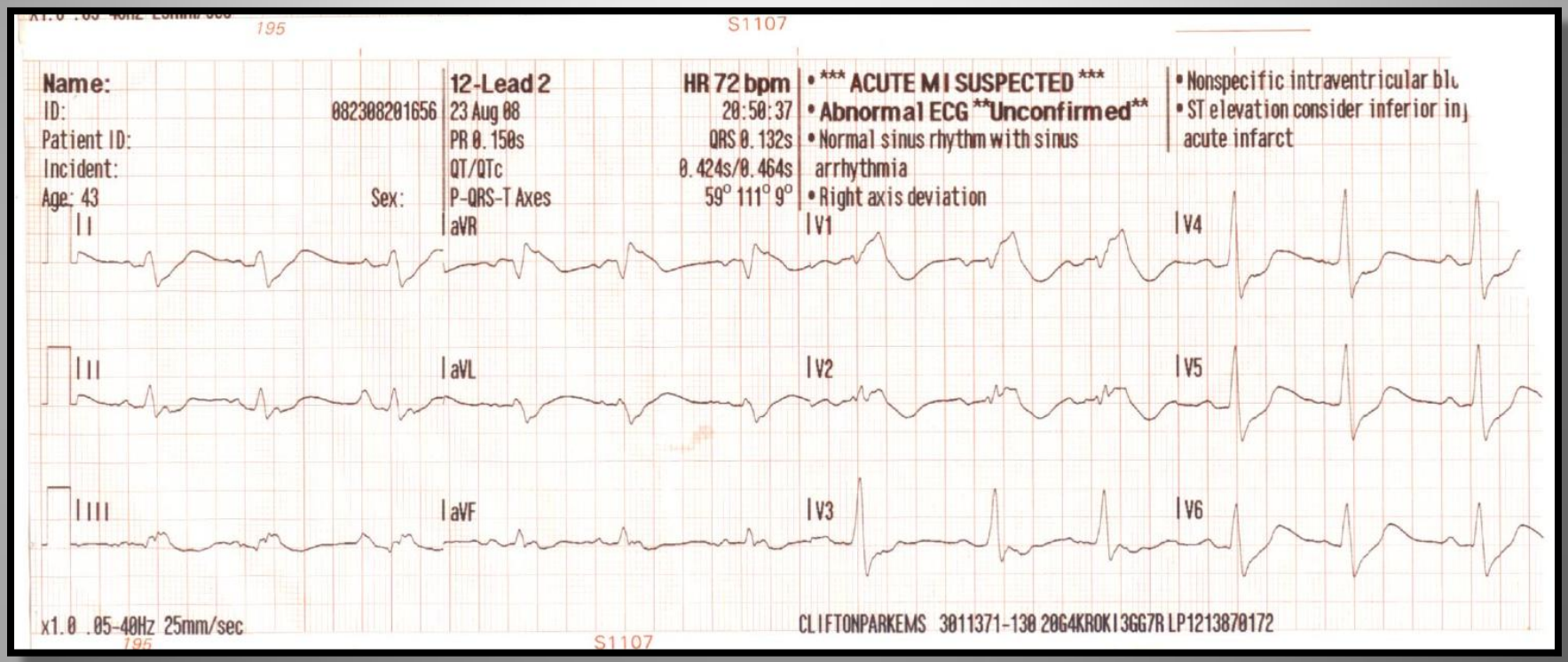
Case 1

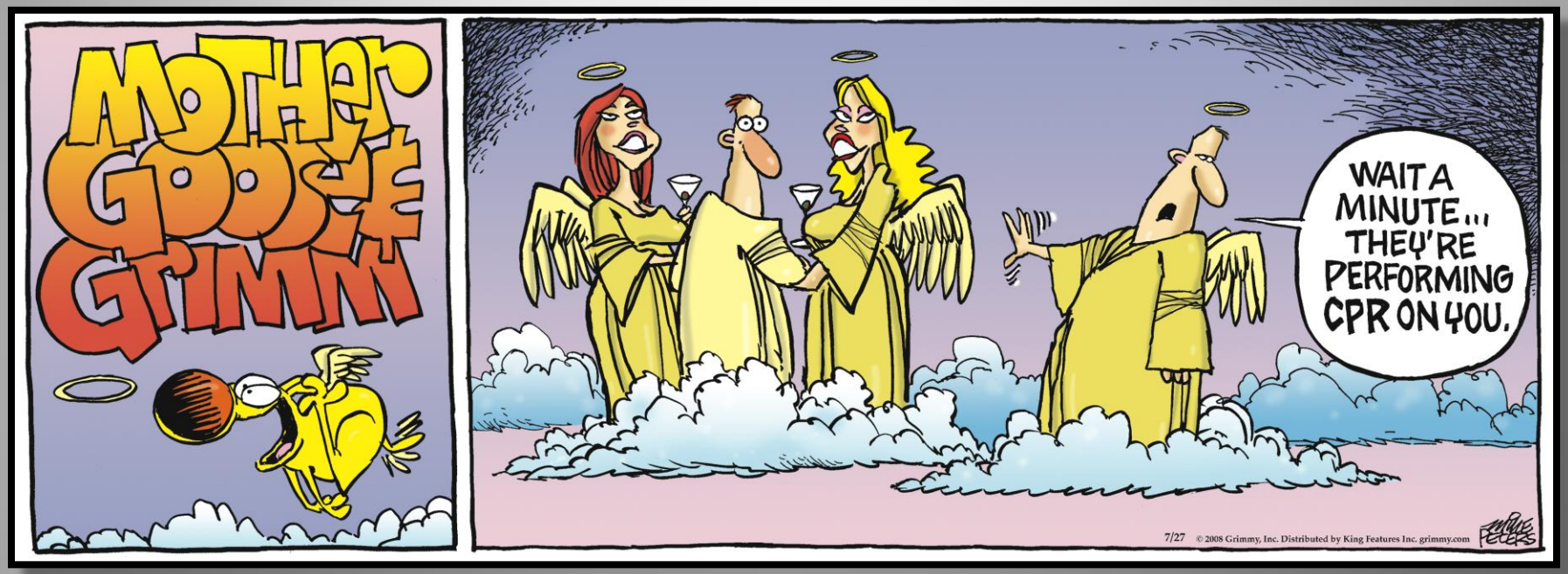
Case 1

- 64 male found down at a fire scene
- CPR in progress
- EMS CPR and multiple shocks


Preshock
Shock 4 360J
Postshock
Combo Pads
Paddles


Paddles


195
S1107
Name:
ID: 082308201656
Patient ID:
Incident:
Age: 43 Sex:
12-Lead 2
23 Aug 08
PR 0.150s
QT/QTc
P-QRS-T Axes
aVR
HR 72 bpm
20:50:37
QRS 0.132s
0.424s/0.464s
59° 111° 9°
• *** ACUTE MI SUSPECTED ***
• Abnormal ECG **Unconfirmed**
• Normal sinus rhythm with sinus arrhythmia
• Right axis deviation
• Nonspecific intraventricular blo
• ST elevation consider inferior inj acute infarct
I
II
III
aVL
aVF
V1
V2
V3
V4
V5
V6
x1.0 .05-40Hz 25mm/sec
CLIFTONPARKEMS 3011371-130 20G4KR0K13GG7R LP1213870172


MOTHER GOOSE GRIMM
WAIT A MINUTE... THEY'RE PERFORMING CPR ON YOU.
7/27
© 2008 Grimmy, Inc. Distributed by King Features Inc. grimmy.com

Incidence – ROC Study

- 10 sites; catchment population was 21.4 million
- 20,520 cardiac arrests, 11 898 (58.0%) had resuscitation attempted;
- 954(4.6% of total) were discharged alive
- 2729 (22.9% of treated) had initial rhythm of ventricular fibrillation or ventricular tachycardia
- Survival ranged from 3.0% to 16.3%
- VF Survival ranged from 7.7% to 39.9%, with a median of 22.0%
- Significant differences across sites for incidence and survival (P<.001)

Regional Variation in Out-of-Hospital Cardiac Arrest Incidence and Outcome, Graham Nichol, et al, JAMA. 2008;300(12):1423-1431.

REMO

Total Results

- 7.9% of all cardiac arrest patients survived
- 21% of all patients in ventricular fibrillation survived
- Take home message:
  - Have your arrest in Seattle or Colonie …not Alabama!

Termination Rules

- ALS rules with 100% sens and spec
- Event not witnessed by EMS
- No defibrillation in EMS setting
- No ROSC in EMS setting
- Arrest not witnessed
- No bystander CPR

(For cardiac etiology arrest only)

Derivation and evaluation of a termination of resuscitation clinical prediction rule for advanced life support providers . Resuscitation , 74 :2 , 266 – 275, L . Morrison , P . Verbeek , M . Vermeulen , A . Kiss , K . Allan , L . Nesbitt , I . Stiell

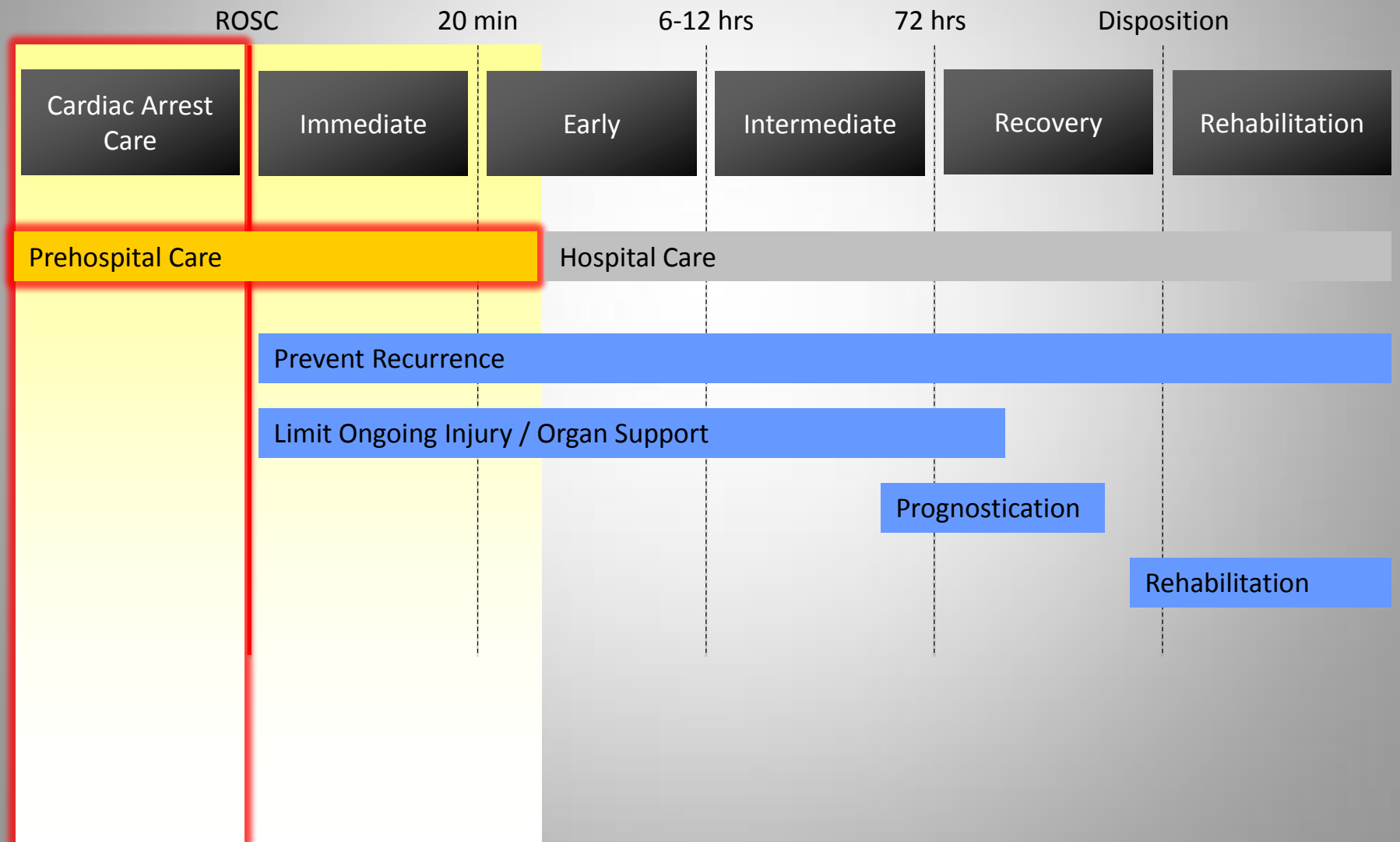
Prehospital termination of resuscitation in cases of refractory out of hospital cardiac arrest JAMA, 300:12:1432-8, C. Sasson, A.J. Hegg, et al

REMO

Take Home Message

- Cardiac arrest is won on the scene
- Transporting a non-viable patient is a waste of resources and very dangerous for EMS providers

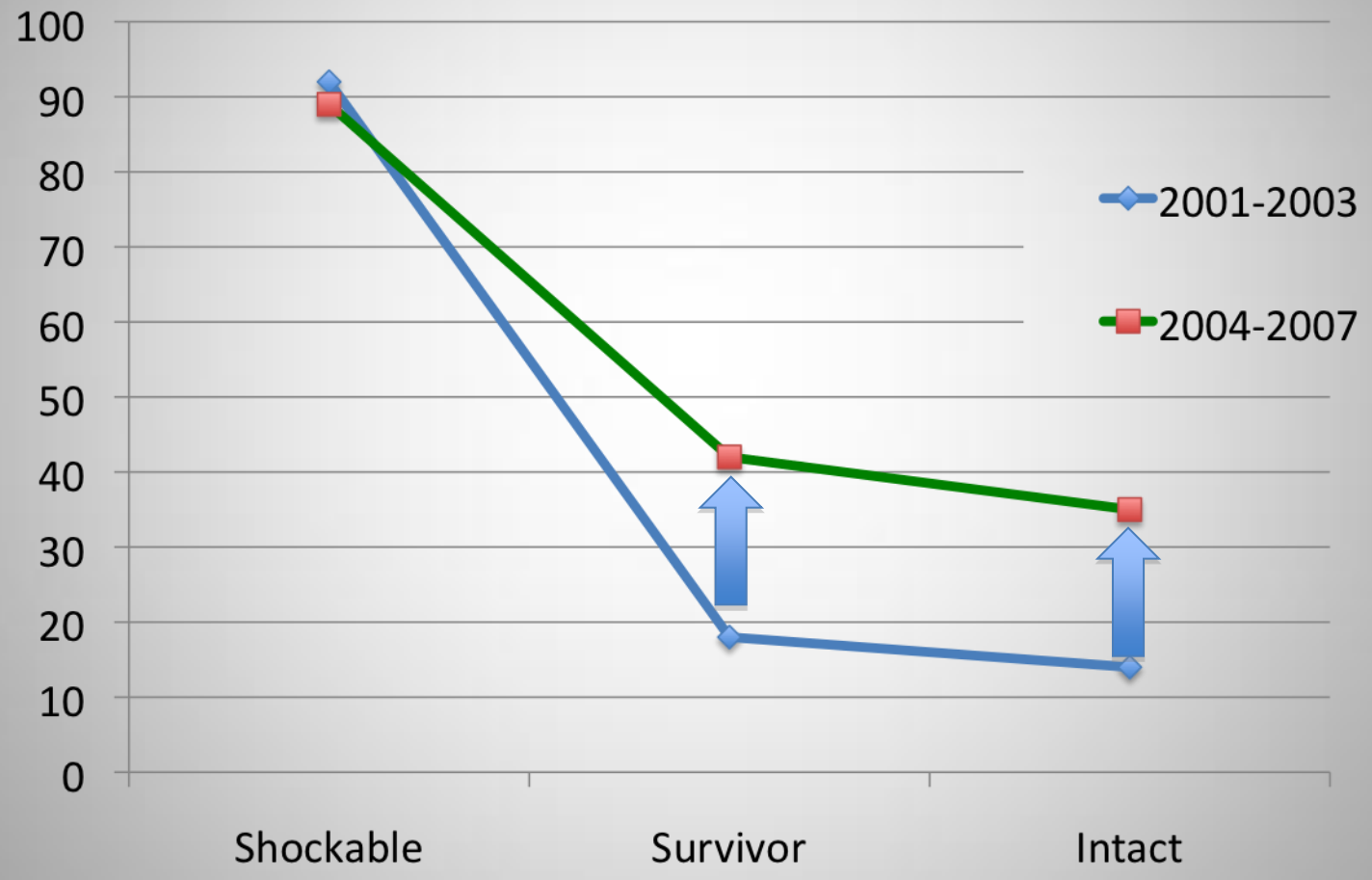
Post-Cardiac Arrest Syndrome



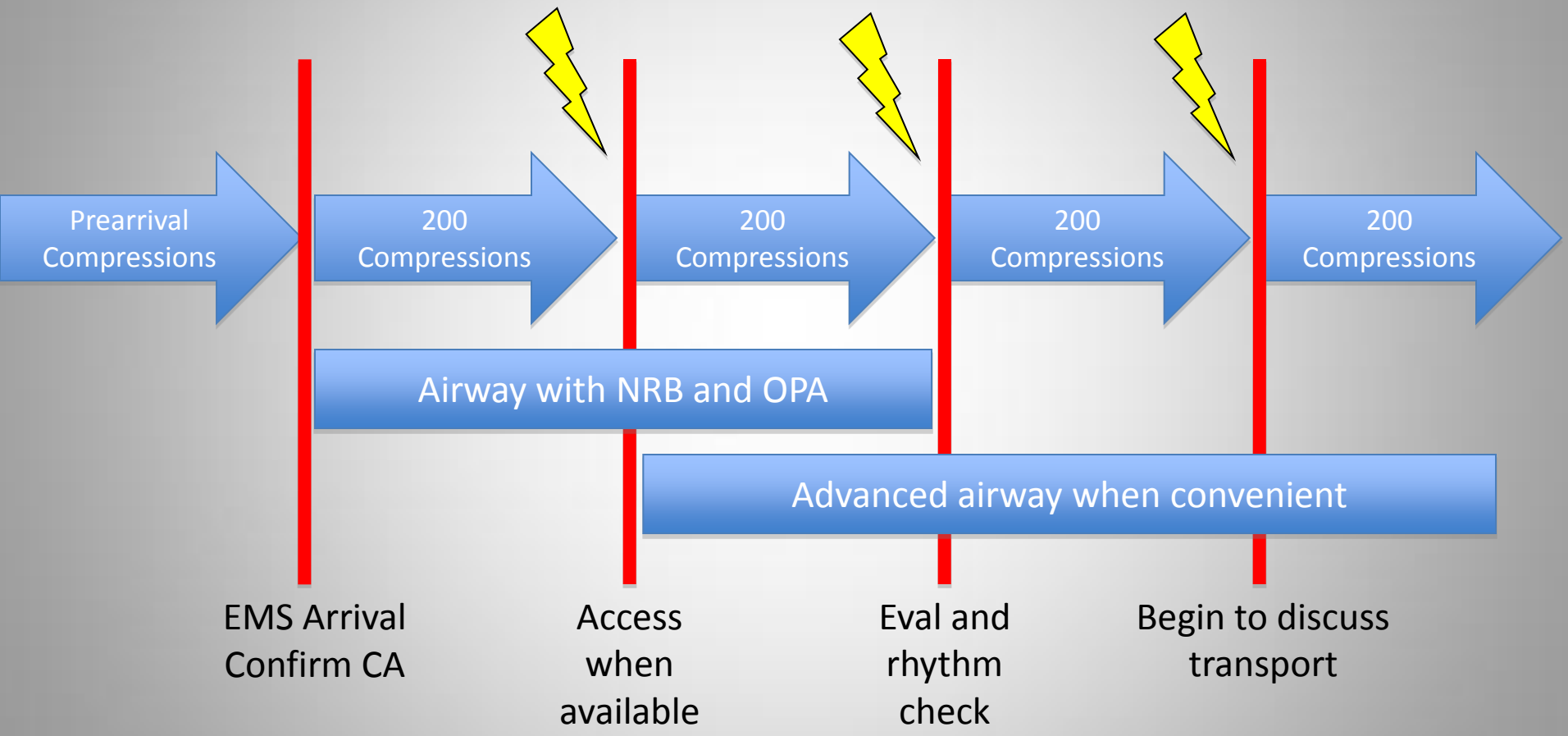
Cardiac Arrest Care

- Compressions
  - Bystander/Prearrival
- Compressions
  - EMS
- Defibrillation
- Access
  - Quick large IV or IO
- Meds
- Airway management
  - King or ETT

Rural Wisconsin



Progress of an Arrest



Interventions that Changed Outcomes

- Bystander CPR – compression only
  - Increases participation
  - Increases early perfusion
- Initial CPR by providers with blow-by oxygen and delayed intubation
- Compressions following defibrillation prior to pulse check or rhythm analysis

Interventions that Do Not Help

- Early intubation
- Excessive ventilation
- CPR in ambulances and moving patients in arrest
- Bad CPR

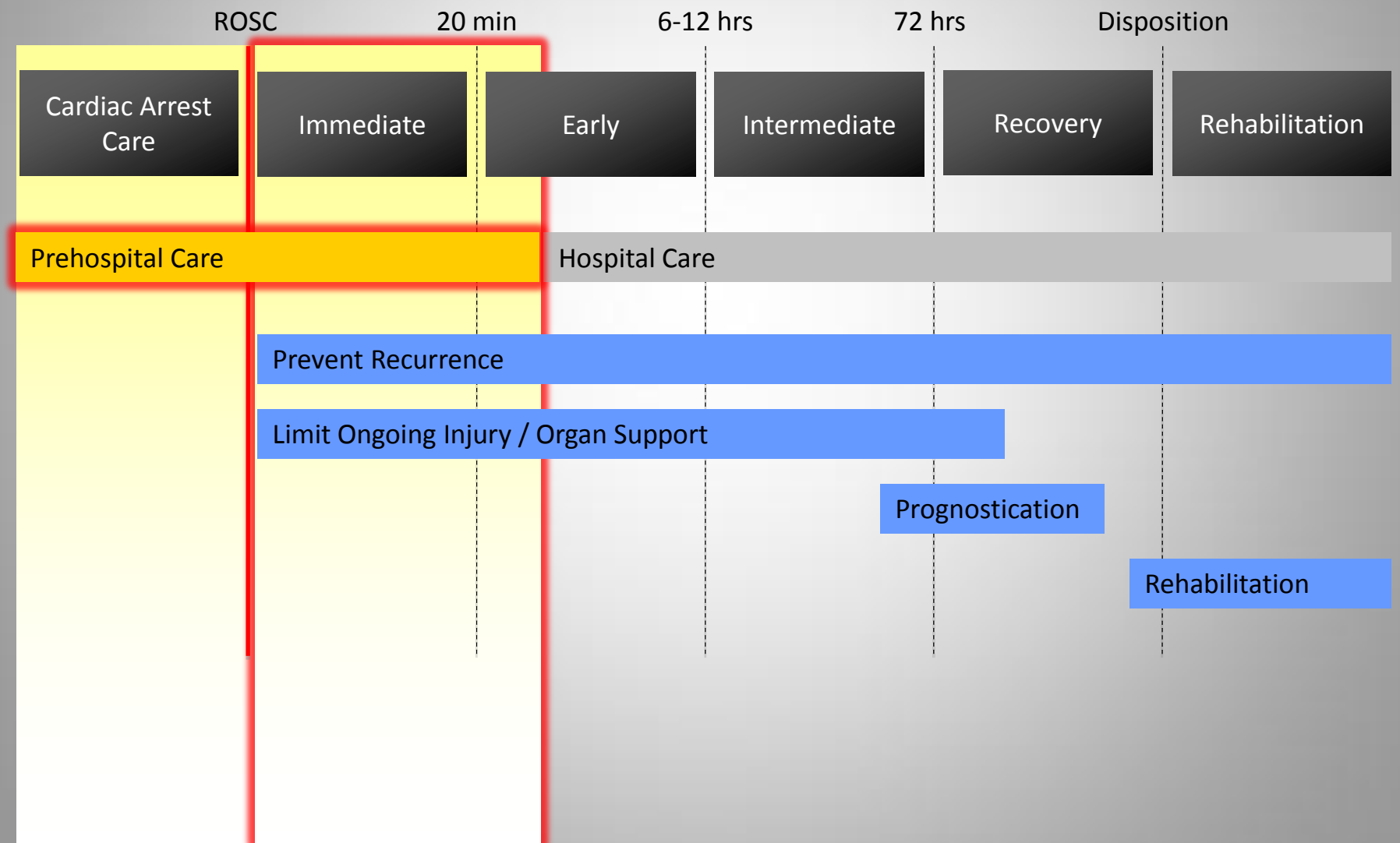
TH Background

What are we really talking about here?

Whe rom?

Did we just cook it up?

Post-Cardiac Arrest Syndrome



What does the literature show?

Look back…

- 1878 – Boehm, closed chest massage on cats
- 1892 – Maass, closed chest massage on a human, with meaningful recovery after 10 days of coma
- 1900 – Prevost and Batelli defibrillate
- 1947 – Beck, open-chest defibrillation “hearts too good to die…”
- 1958-1962 – Kouwenhoven, Safar, CPR!

HEART-LUNG RESUSCITATION

FIRST AID: OXYGENATE THE BRAIN IMMEDIATELY

IF UNCONSCIOUS

Airway – *TILT HEAD BACK*

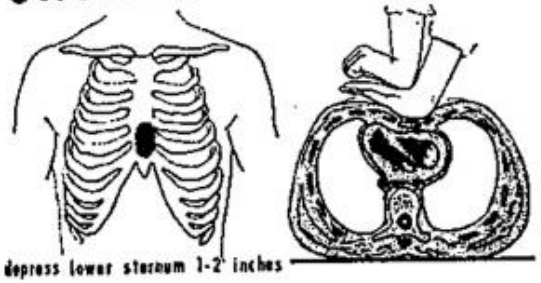
IF NOT BREATHING

Breathe – *INFLATE LUNGS 3-5 TIMES, MAINTAIN HEAD TILT*

MOUTH-TO-MOUTH, MOUTH-TO-NOSE, mouth-to-adjunct, bag-mask

- FEEL PULSE
- IF PRESENT – CONTINUE LUNG INFLATIONS
- IF ABSENT –

Circulate – *COMPRESS HEART ONCE A SECOND. ALTERNATE 2-3 LUNG INFLATIONS WITH 15 STERNAL COMPRESSIONS UNTIL SPONTANEOUS PULSE RETURNS.*



START SPONTA

Drugs – *EPINEPH*

SODIUM

E. K. G. – • *FI*

• *IF*

Fluids – *I.V.*

Do not

Trached

AFTER

e.g

SUPPORT REC

Gauge

Hypothermia

Intensive Care

SUPPORT VENTILATION: TRACHEOTOMY, PROLONGED CONTROLLED VENTILATION, GASTRIC TUBE AS NECESSARY

SUPPORT CIRCULATION

CONTROL CONVULSIONS

MONITOR

HEART-LUNG RESUSCITATION

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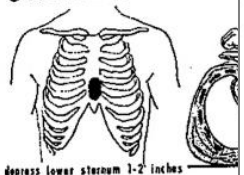
Breathe – INFLATE
MAINTA
MOUTH-TO-M
mouth-to-adj

- FEEL PULSE
- IF PRESENT – C
- IF ABSENT –

Circulate – COMP



START SPONTA

Drugs – EPINEPH
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• IF

Fluids – I.V.
Do no
Trache
AFTER
e.g

SUPPORT REC

Gauge
Hypothermia
Intensive Car

SUPPORT CIRCULATION
CONTROL CONVULSIONS
MONITOR

for physicians only

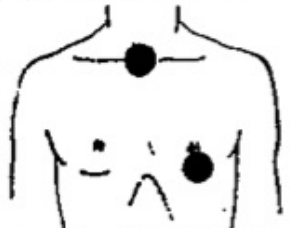
START SPONTANEOUS CIRCULATION

Drugs – *EPINEPHRINE:* 1.0 mg (1.0 CC OF 1:1000) I.V. OR 0.5 mg INTRACARDIAC.
REPEAT LARGER DOSE IF NECESSARY

SODIUM BICARBONATE: APPROXIMATELY 3.75 G/50 CC (1/2 DOSE IN CHILDREN) I.V.
REPEAT EVERY 5 MINUTES IF NECESSARY

E. K. G. – • *FIBRILLATION:* EXTERNAL ELECTRIC DEFIBRILLATION. REPEAT SHOCK EVERY 1-3 MINUTES UNTIL FIBRILLATION REVERSED

• *IF ASYSTOLE OR WEAK BEATS:* EPINEPHRINE OR CALCIUM I.V.



A.C.: 600 – 1000 V 0.25 sec
or D.C.: 150 W/sec 0.0025 sec

Fluids – *I.V. PLASMA, DEXTRAN, SALINE*
Do not interrupt cardiac compressions and ventilation.
Tracheal intubation only when necessary.
AFTER RETURN OF SPONTANEOUS CIRCULATION USE VASOPRESSORS AS NEEDED,
e.g. NOREPINEPHRINE (Levophed) I.V. DRIP

SUPPORT RECOVERY

(physician-specialist)

Gauge
Hypothermia
Intensive Care

EVALUATE AND TREAT CAUSE OF ARREST

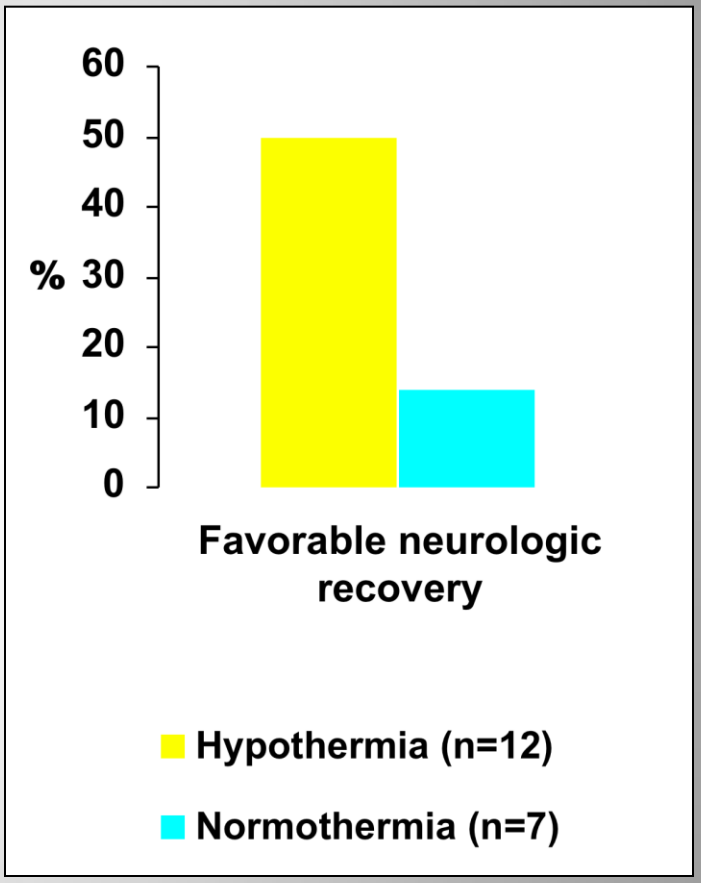
START WITHIN 30 MINUTES IF NO SIGN OF CNS RECOVERY

SUPPORT VENTILATION: TRACHEOTOMY, PROLONGED CONTROLLED VENTILATION, GASTRIC TUBE AS NECESSARY

SUPPORT CIRCULATION
CONTROL CONVULSIONS
MONITOR

First formal TH study…1959!

- Benson DW, et al. *Anesth Analg* 1959; 38: 423-8.



What happened then?

- What temperature?
  - Mild? 34-36
  - Moderate? 30-32
  - Profound? 10
- How to induce?
- How to maintain?
- What about complications?

What causes brain injury?

- Duration and severity of ischemia (primary)
- Direct injury during reperfusion (secondary)
  - Oxygen free-radicals
  - Lipid cell membrane damage
  - Decreased effectiveness of Na/K+ cellular pump
  - Lactate production

What causes brain injury?

- Release of toxic compounds caused by the reperfusion of brain cells (tertiary)
  - Increased neurotransmitters
  - Hyper-excited receptors
- Hyperthermia from primary brain response

Why does TH work?

- TH decreases brain metabolism by:
  - Retarding the initial rate of ATP depletion at membrane
  - Reducing neurotransmitter release
  - Altering intracellular messenger activity
- TH may prevent cellular damage by:
  - Limiting breakdown of the blood–brain barrier
  - Reducing inflammatory responses
  - Reducing intracellular calcium
  - Maybe even altering gene expression and protein synthesis

What has been tried?

- Barbiturates
- Calcium channel blockers
- Escalating epinephrine
- Steroids
- Etc…

The New England Journal of Medicine

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

VOLUME 346 FEBRUARY 21, 2002 NUMBER 8

2005 - ILCOR

- ALS Task Force of International Liaison Committee on Resuscitation
- “Unconscious adult patients with spontaneous circulation after out-of-hospital cardiac arrest should be cooled to 32C-34C for 12 to 24 hours when the initial rhythm was V Fib.”
- “Such Cooling may also be beneficial for other rhythms or in hospital cardiac arrest”

Number needed to treat?

- ASA in MI?
  42
- STATINS?
  364
- Therapeutic hypothermia?
  6!

McAlister FA. The "number needed to treat" turns 20 — and continues to be used and misused. CMAJ 2008;179:549-53

Holzer M, Bernard SA, Hachimi-Idrissi S, Roine RO, Sterz F, Müllner M. Hypothermia for neuroprotection after cardiac arrest: systematic review and individual patient data meta-analysis. Crit Care Med. 2005;33:414–418.

REMO

Therapeutic Hypothermia
A Case Report

Case

- 48 year old male asleep next to his wife starts to “breath funny”
- Unable to arouse him – call 911
- Pre-arrival instructions

Case

- CPR and defib by EMS
- BVM
- IV epi and amiodarone
- Intubation following ROSC
- GCS 4 upon arrival
- CT head shows cerebral edema…

Mr. Phillips,

$(6.67\times10^{-11}\ N\cdot m^2/kg^2)(mc^2)\left(\frac{\Delta v}{a}\right)$

$(Fd)(mc^2)(\sigma AT^4)(\sigma AT^4)$

$\left(\frac{1}{2}\right)(\cos(90))(\sin(90))\ N$

Regional statistics from 2009

- Albany Medical Center Hospital
  - Program 2009 data
  - 42 EMS ROSC Pts
  - 22 (>50%) have “returned to a normal life”
  - <10 (<24%) historically would have
- Ellis Hospital
  - 4/7 have “returned to a normal life”


WILDFOWLER
Champlain

So how are we doing it?


EMPIRE


LIFEPAK


DELMAR
EMS
CERTIFIED
264
13017-ET

EMS Goals

- Prevent recurrence
- Prevent ongoing injury and organ support
- What does this mean?
  - Arrhythmia control
  - Airway management
  - BP control
  - Glucose control
  - Seizure control

Inclusion Criteria

- ROSC Patient has a GCS < 8
- Patient age > Puberty
  - Males = arm pit hair (AHA)
  - Females = breast development (AHA)
- Airway
  - ALS: ALS/BLS airway w/ EtCO2
  - BLS: Patient BLS airway w/ adequate ventilations

Exclusion criteria

- Known or suspected to be pregnant
- Trauma patients
- Suspected sepsis
- Other causes of coma (such as drug intoxication or status epilepticus)
- Recent major surgery within 14 days

* Contact receiving facility for clarification if ?

Transport of the ROSC Pt

- ROSC patients receiving TH must be transported to a TH receiving facility if less than 60 minute transport time:
  - AMC, CMH, Ellis, Glens Falls, St. Peters, Sam, so far…
  - If the ROSC Pt degrades to recurrent cardiac arrest transport to closest hospital
  - If the patient has a STEMI call Medical Consultation to discuss appropriate destination

Documentation of the ROSC Pt

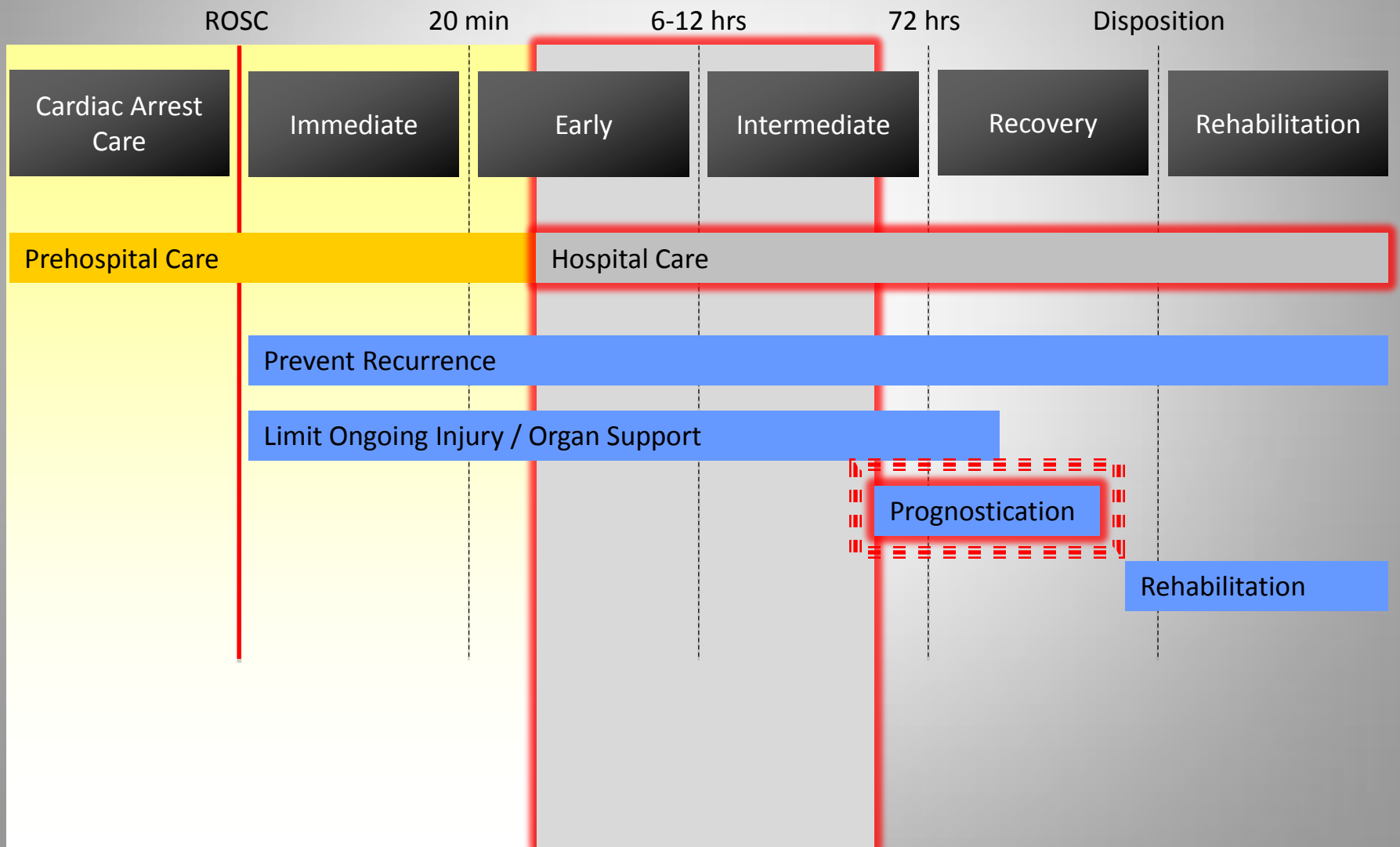
- A complete post ROSC patient assessment
  - GCS must include specific elements
  - Pupil exam
- Interpretation of post ROSC EKG & 12 lead EKG
- TH inclusion criteria
- Cooling methods administered
- Completion of the CARES registry entry

Big question…what about intra-arrest cooling?

What about intra-arrest cooling?

- Minimal data from outcomes studies
- Significant suggestive data:
  - Dogs: Improved resuscitation in hypothermic dogs
  - Swine: Improved resuscitation with hypothermic fluid infusion
- Human examples:
  - Approved for NYC
  - Ongoing in Richmond
  - Cases in NC, Pgh, others

Post-Cardiac Arrest Syndrome



Hospital Care

- Therapeutic hypothermia
  - 32-34 C for 24 hours
- Glycemic control
- Oxygen management
- Ventilatory management
- NO EARLY prognostication!
  - Can not evaluate for ultimate outcomes for at least the first 48 hours

Bottom line

- Cardiac arrest should be a terminal event in many cases…
- When it should not be, we must optimize the probability of meaningful recovery
- Doctors need prompting to bring new therapies to our patients…
- Therapeutic hypothermia is not new

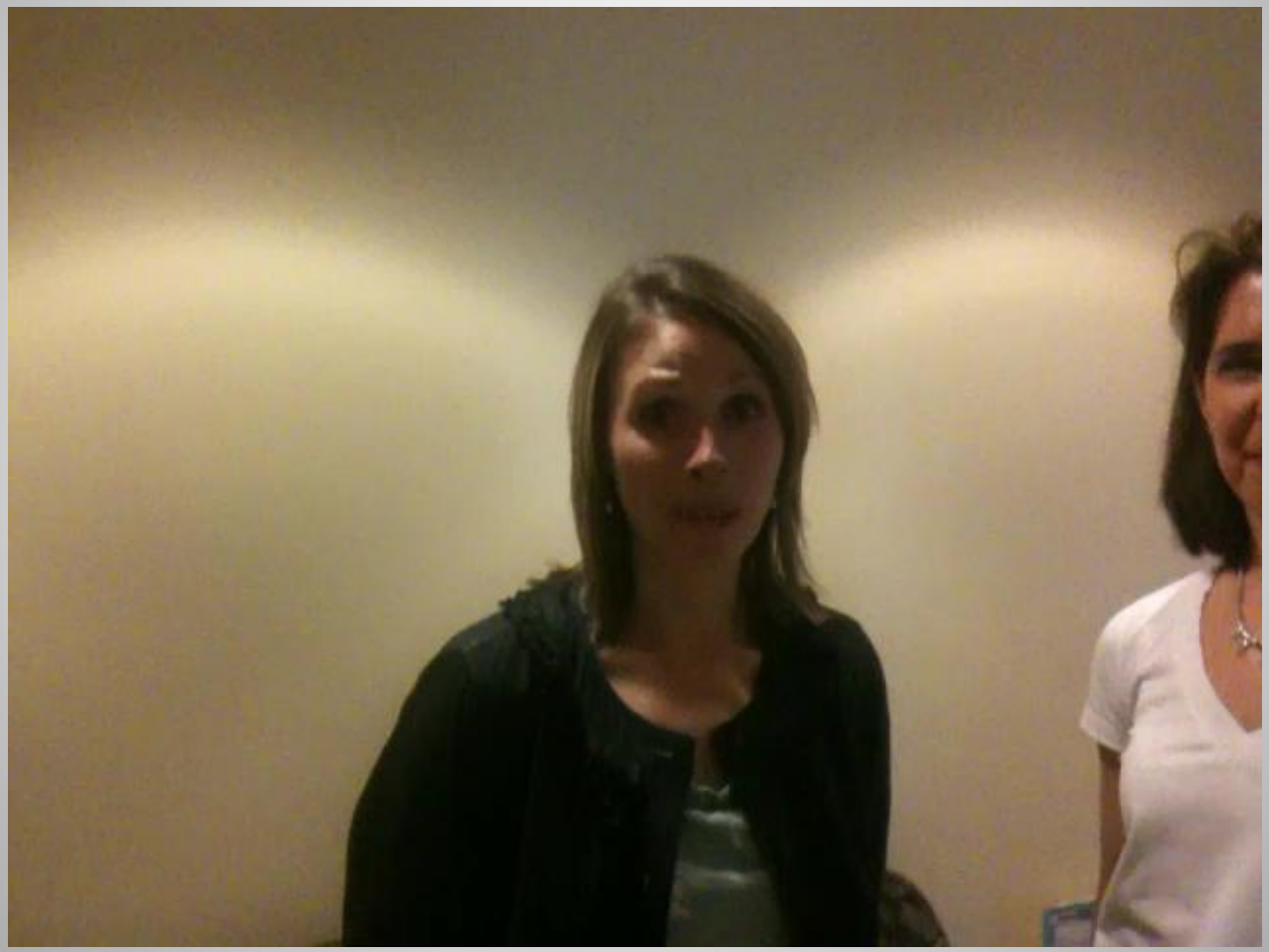

LIFEPAK 10

Remember…

- Get ‘em back, then chill ‘em
- No therapeutic hypothermia program is successful without good initial EMS care
- More than 30 people in the area are alive today because EMS saved them, and gave them a chance for therapeutic hypothermia
- The success of the hospital TH programs is a testament to good EMS care

“The physician’s choice between prolonged resuscitative efforts and a dignified and peaceful death in patients with incurable disease is part of the art of resuscitation.”

- P. Safar, 1964




QUESTIONS?

Questions?


JULY
Food Fight!


Symbicort