Post Cardiac Arrest Syndrome, Care and Hypothermia

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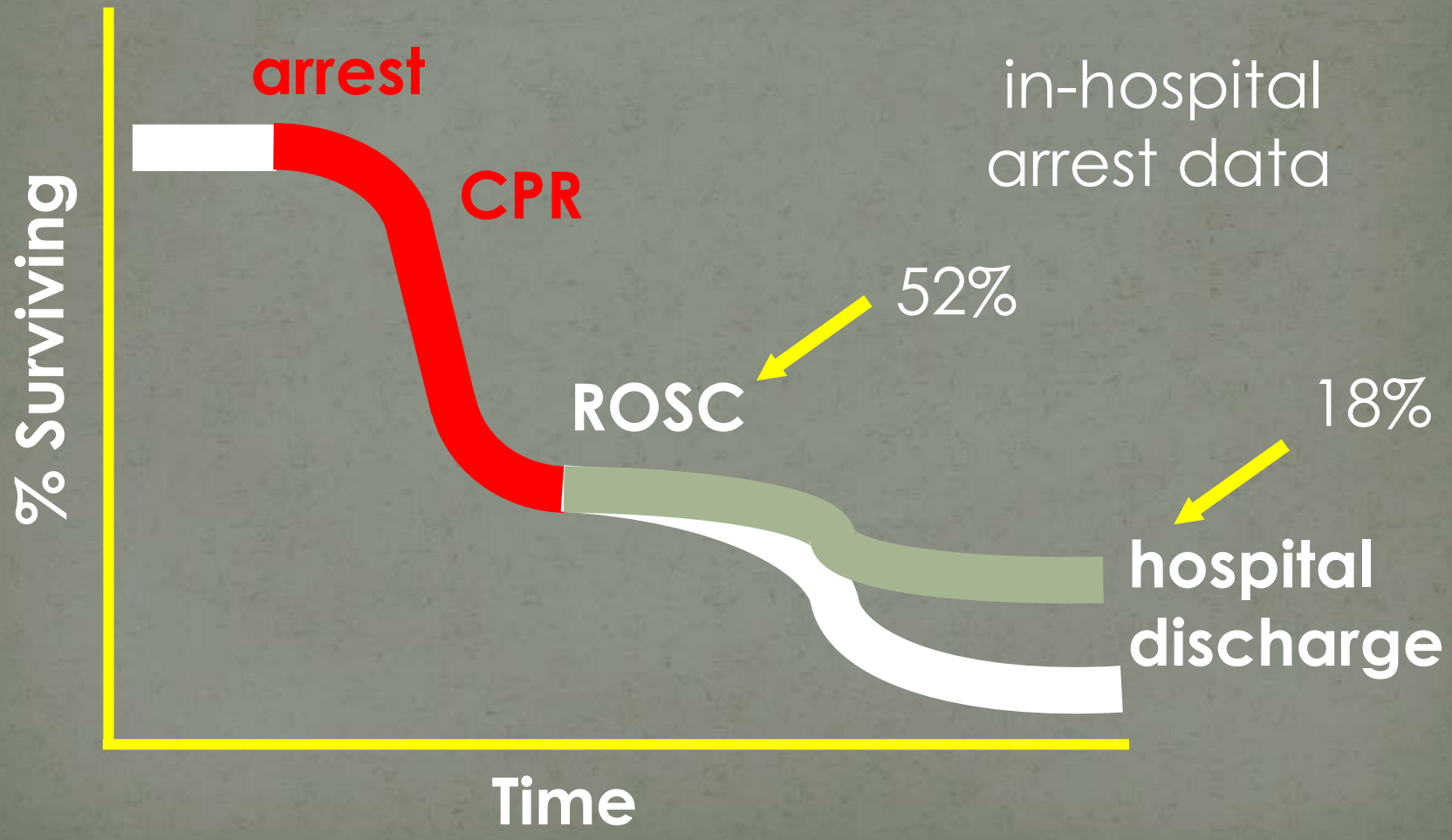
The Pulse Returns…

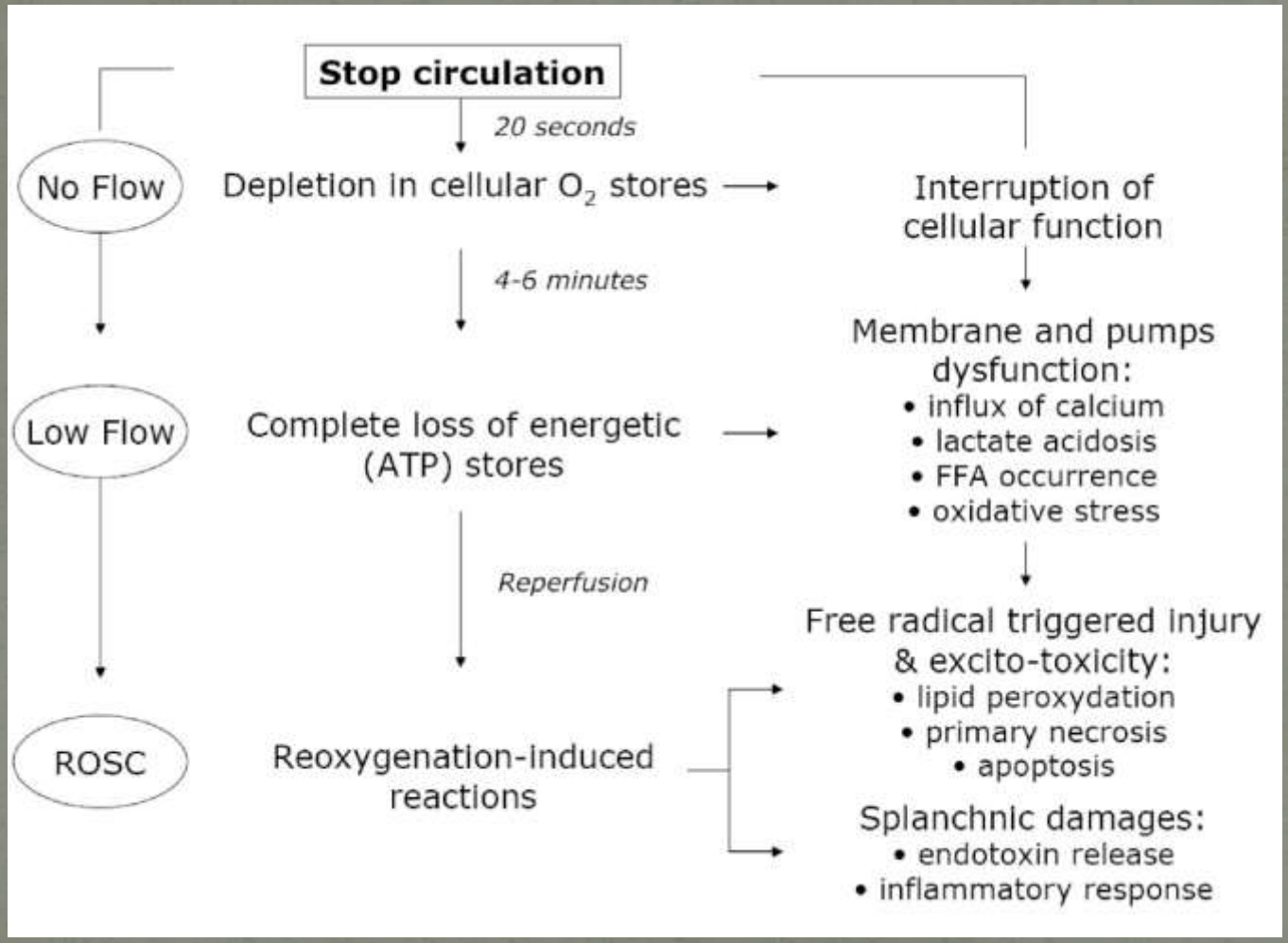
The post-arrest problem



Post Cardiac Arrest Syndrome

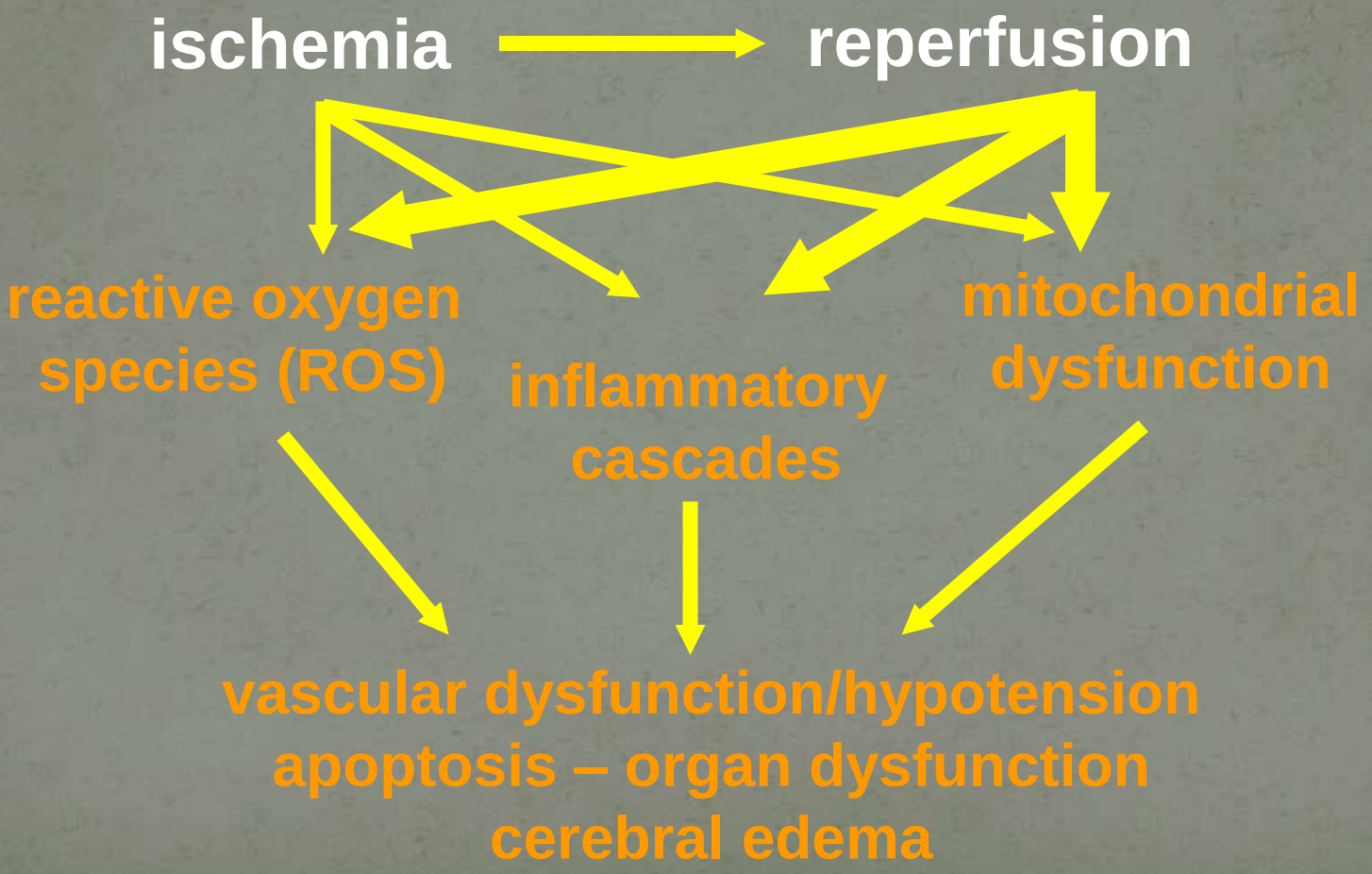
- Persistent precipitating pathology
- Anoxic brain injury
- Post-cardiac arrest myocardial dysfunction
- Systemic ischemia/reperfusion response

Post Cardiac Arrest Syndrome



Mongardon et al. Annals of Intensive Care 2011 1:45
doi:10.1186/2110-5820-1-45

PCAS


ischemia
reperfusion
reactive oxygen species (ROS)
inflammatory cascades
mitochondrial dysfunction
vascular dysfunction/hypotension
apoptosis – organ dysfunction
cerebral edema

Post-ROSC Care Bundle

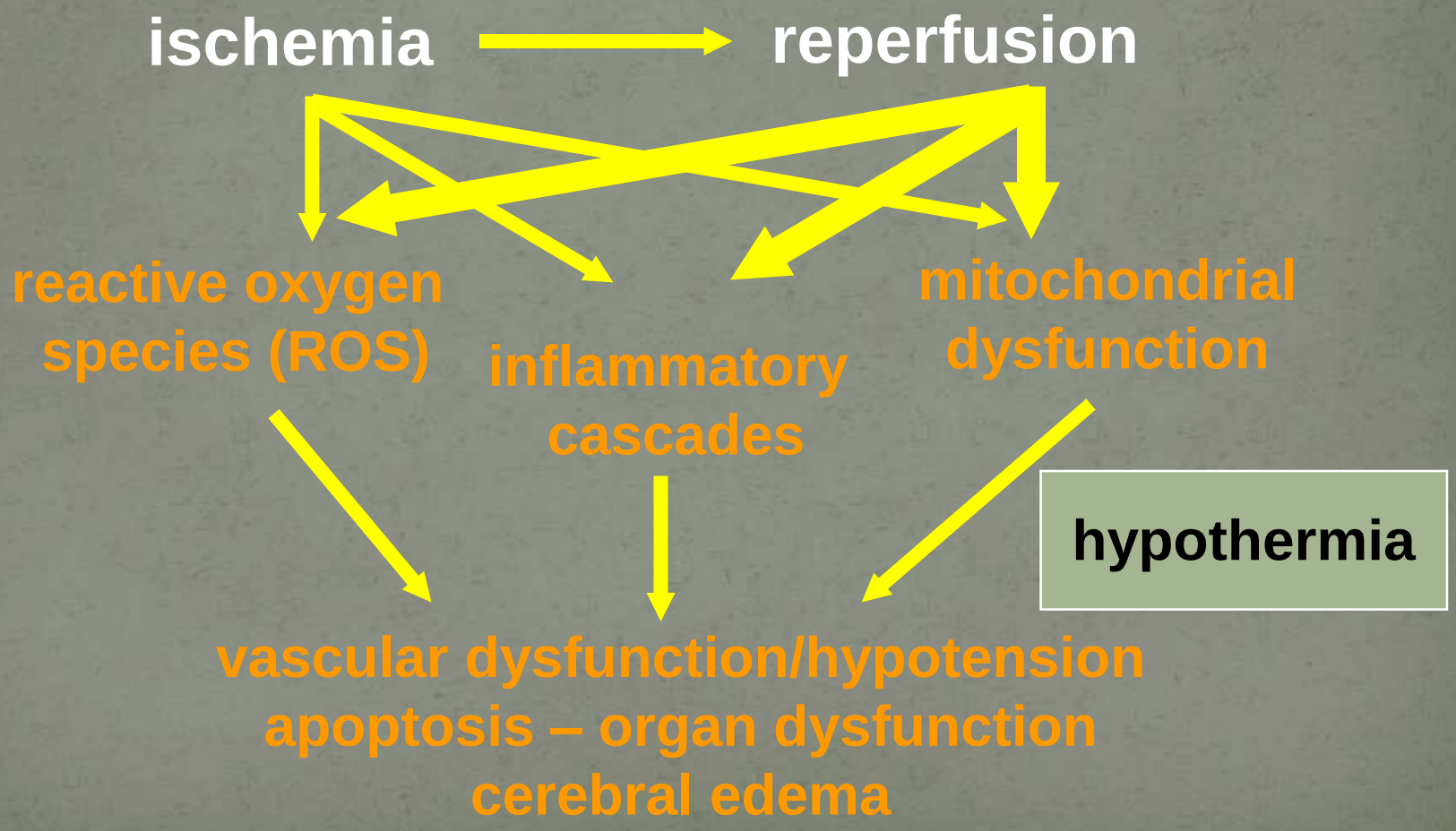
- **Identification and treatment of the cause**
  - **PCI**
- Airway & ventilation management
- Haemodynamic management
- **Targeted Temperature Management / Therapeutic Hypothermia**
- Glycaemic control
- Seizure management and Neuroprognostication

Therapeutic Temperature Management (TTM)

- Cerebral metabolism increases 8% per degree Celsius ***increase***
- Decreases 7% per degree Celsius ***reduction***

- → Prevent fever
- Better still, induce hypothermia

Hypothermia mechanisms



Historically…

Russian Method 1803

Baron Dominique Jean Larrey

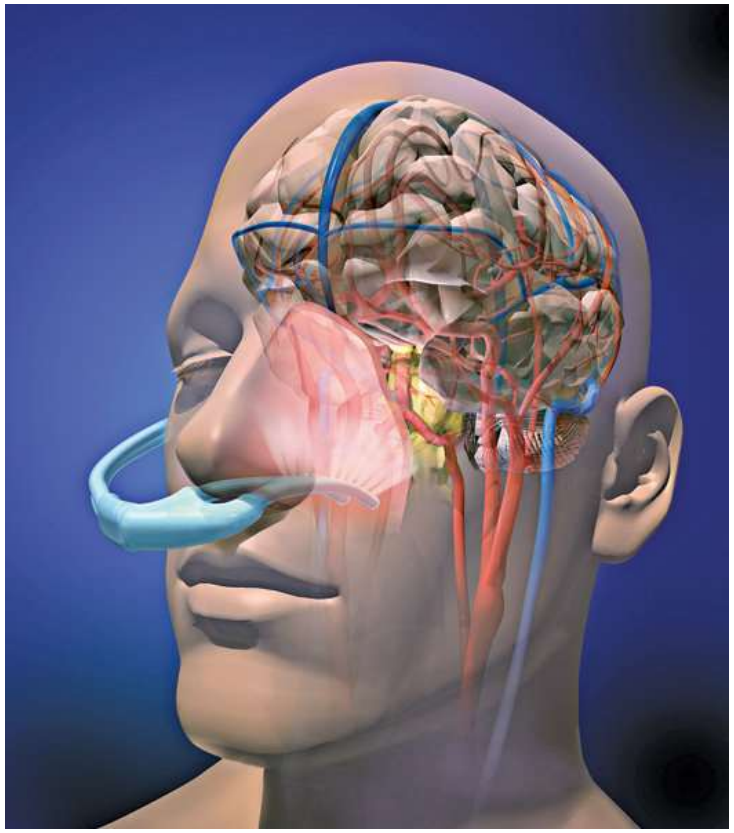
Cooling methods

External Cooling

Internal Cooling

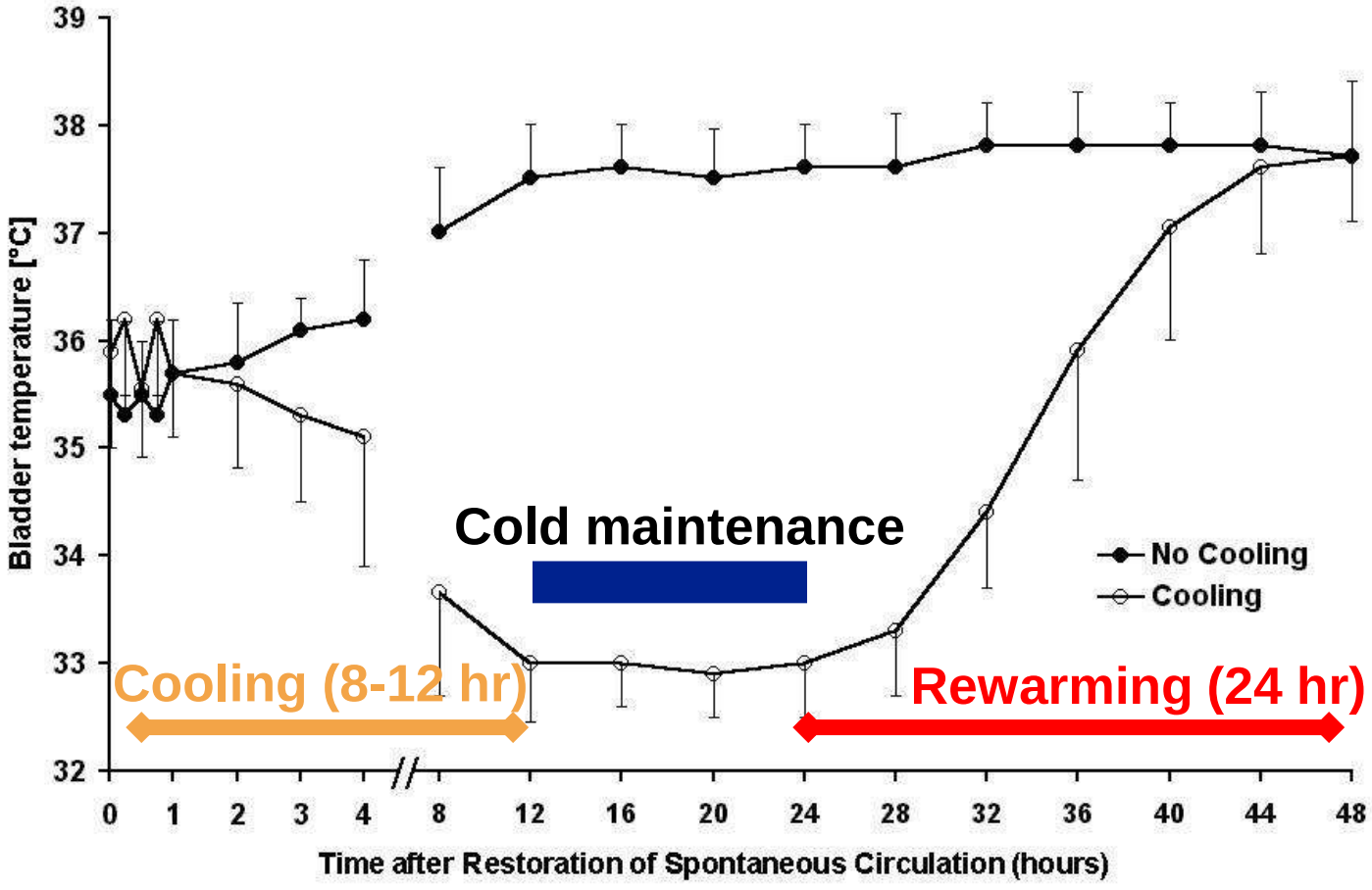
Cooling methods

Specialised cooling pads



Evaporative cooling

What cooling looks like



HACA, 2002

Modern era of hypothermia use

HACA, 2002

The New England Journal of Medicine

VOLUME 346 FEBRUARY 21, 2002 NUMBER 8

INDUCED HYPOTHERMIA AFTER OUT-OF-HOSPITAL CARDIAC ARREST

Bernard, 2002

Resuscitation 51 (2001) 275–281

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

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

Department of Critical Care Medicine and Cerebral Resuscitation Research Group, AZ-VUB, Free University of Brussels, Laarbeeklaan, 101, B-1090, Brussels, Belgium

Idrissi, 2001

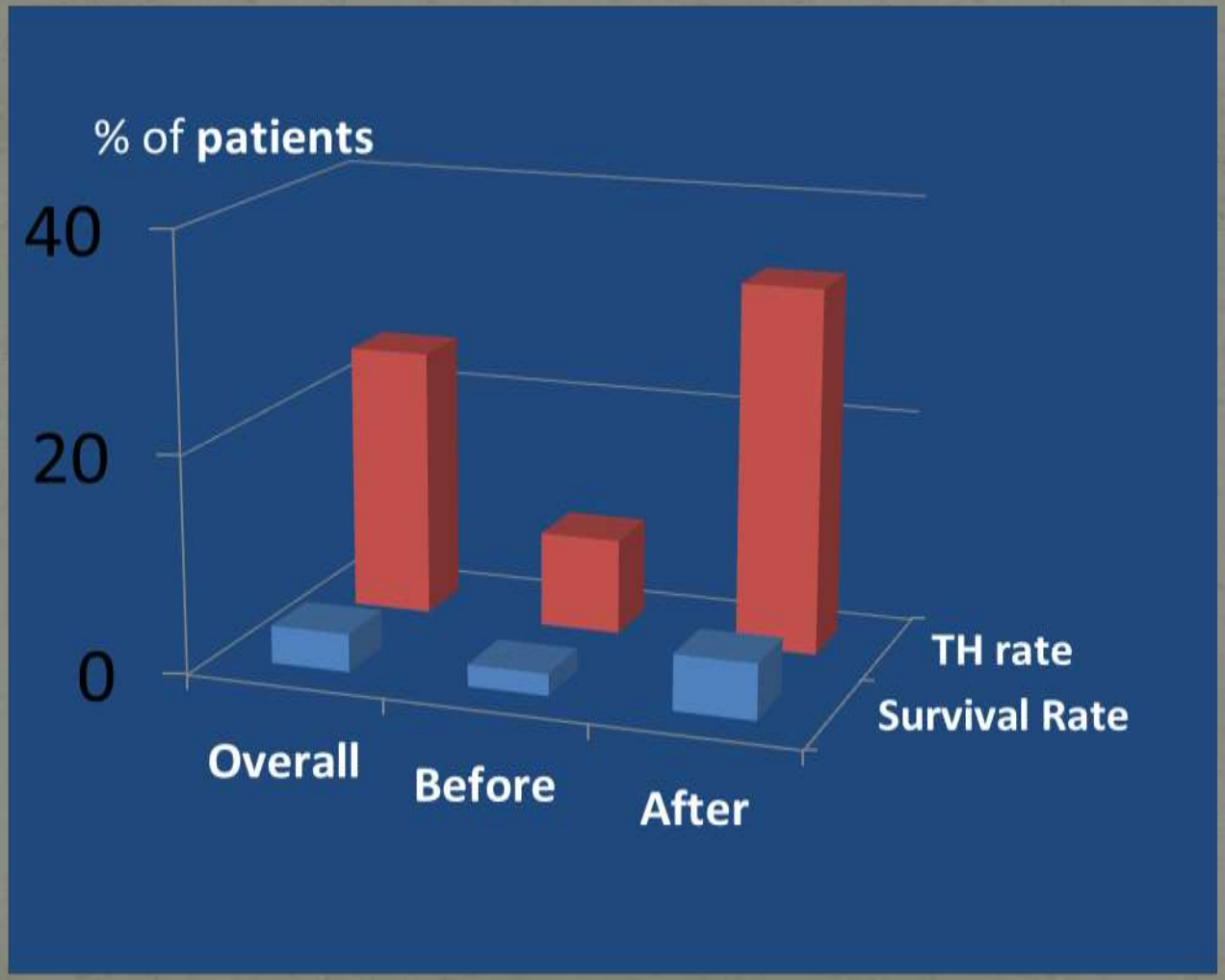
Side effects of Hypothermia..

- Slowing of heart rate
- Shivering
- Increased bleeding
- Increased infections
- Fluid, Electrolyte and glucose changes
- Drug metabolism changes
- Procedural-specific risks

- **Bottom line, TH is relatively safe!**

Feb 2012 – 1st U Penn TH course in Sg!

Before and after TH protocol



Factors associated with survival

	Univariate Analysis		Multivariate Analysis	
Factors	Odds Ratio of Survival	p value	Odds Ratio of Survival	p value
Age	0.956	0.001	0.953	**0.004**
Male Gender	0.572	0.163		
DM	0.692	0.358		
CKD	0.803	0.642		
LVEF ≤ 40	0.636	0.437		
VF	8.62	<0.001	4.18	**0.015**
CCU	4.26	0.001	2.32	0.214
TH	1.11	0.805	2.97	**0.063**
Protocol	1.41	0.412	2.20	0.132

Factors associated with survival

Factors	n (%)	Discharged Alive	
		OR	95% CI
Bystander CPR present	801 (20.3)	**2.29**	**1.17 – 4.39**
Public access defibrillation present	14 (0.36)	**11.10**	**1.18 – 51.6**
FRP dispatched	97 (2.46)	**4.63**	**1.58 – 11.1**
Ambulance defibrillation	853 (21.6)	**6.04**	**3.47 – 10.71**
EMS mechanical CPR	30 (0.76)	2.25	0.05 – 14.05
Hospital mechanical CPR	328 (8.32)	1.22	0.43 – 2.88
Hospital hypothermia therapy	10 (0.25)	**28.9**	**4.72 – 131.0**

More Reputable Publications!

Cooling the body can 'cut risk of fatality' after cardiac arrest

By POON CHIAN HUI

CARDIAC arrest sufferers can be kept alive using a new technique that cools their bodies to below the normal temperature and then slowly reheats them.

The "therapeutic hypothermia" treatment more than triples their chances of surviving, according to preliminary results of a clinical trial in Singapore.

It also reduces the risk of brain damage – a common problem among those who live.

The technique – which is already used in countries such as Australia – spells new hope for the 1,500 people in Singapore who suffer a cardiac arrest outside hospital every year.

At the moment, their survival rate is a dismal 2.7 per cent.

First, the patient's body is rapidly cooled to between 32 deg C and 34 deg C. This is done either by wrapping large cooling-gel pads around the torso and legs or by pumping cool saline into a catheter that is inserted into the body.

The temperature is then maintained for 24 hours while the patient is put into a medically induced coma.

After that, the body is gradually warmed to the normal 36.5 deg C.

Bringing the temperature down helps to save barely alive cells, said Associate Professor Marcus Ong, who is the lead researcher in the trial at Singapore General Hospital (SGH).

This is because when oxygen is cut off during a cardiac arrest, "it starts a chain reaction that ultimately leads to cell death".

But when the cells are cooled, they do not need as much oxygen, which reduces the damage.

"If left alone, the area of damage would increase and becomes permanent," added Prof Ong, a senior consultant in emergency medicine at the hospital.

Forty cardiac arrest patients aged 18 to 80 were involved in the clinical trial between 2008 and last year.

Most of the survivors given conventional intensive care ended up in a coma or vegetative state.

By contrast, more than half of the patients who received the hypothermia treatment woke up with minimal brain damage.

They include information technology manager Peng Hua, who collapsed suddenly at work last September.

Colleagues and paramedics managed to resuscitate him. And by the time the 39-year-old arrived at hospital, his heart had started beating again.

He was then cooled and slowly warmed again, using the catheter system.

The first few days after waking up were hazy, but he later found he could "remember all that I was supposed to remember".

"I can recognise people, I can do everything just as before," said Mr Peng, who is married with one daughter.

"My memory came back to me all in one piece."

The cooling treatment is currently offered for free at SGH as as part of the clinical trial, which is set to run for another year and involve a total of about 50 patients.

Not everyone is suitable, however. Patients need to have a stable pulse and blood pressure.

They also have to be unresponsive after being revived. The cause of the cardiac arrest should not be a traumatic event, such as a car crash, as the person may have other injuries.

National University Hospital has also started applying the technique to selected patients.

Dr Benjamin Leong, a consultant in its emergency medicine department, said the results had been encouraging – with a roughly 30 per cent survival rate for those treated this way.

The hospital uses temperature-control mattresses which circulate cold or warm water to regulate body temperature.

But therapeutic hypothermia "will not resurrect what is already dead", said Prof Ong.

"It preserves what is still alive. It will not bring the dead back to life."

chpoon@sph.com.sg

Associate Professor Marcus Ong (right), the lead researcher in the clinical trial on "therapeutic hypothermia", with the cooling system, which was used on cardiac arrest survivor Peng Hua (left). ST PHOTO: LAU FOOK KONG

How therapeutic hypothermia works

COOLING the body of someone whose heart has stopped can help to reduce the amount of permanent damage done to organs, including the brain.

This is because it reduces the cells' need for oxygen, so that they are less likely to die.

In the Singapore General Hospital's (SGH) clinical trial, a patient is cooled to between 32 deg C and 34 deg C, after his heartbeat and blood pressure are stabilised.

He is kept cooled for 24 hours, after which he is warmed back to the body's normal temperature of 36.5 deg C, [illegible] Professor Marcus Ong.

There are two ways of cooling the patient, called therapeutic hypothermia.

The first is to do it from the inside, by inserting a catheter into the patient. Cool saline is circulated into the catheter and this cools the blood down.

Otherwise, gel pads, through which cool fluid is passed, can be wrapped around the torso and legs.

TTM Recommendations

- OHCA with shockable rhythms
  - Strong recommendation
- OHCA with nonshockable rhythms
  - Weak recommendation
- IHCA (all rhythms)
  - Weak recommendation
- Prevention of fever
  - Strong recommendation

TTM targets

- 33-36 degrees
  - Minimise temperature variations to within 1 degree
- OHCA with shockable rhythms
  - 33 degrees recommended
- All other rhythms or contraindications to lower temperature
  - 36 degrees

More than just hypothermia

Post-arrest care is a critical care "bundle":

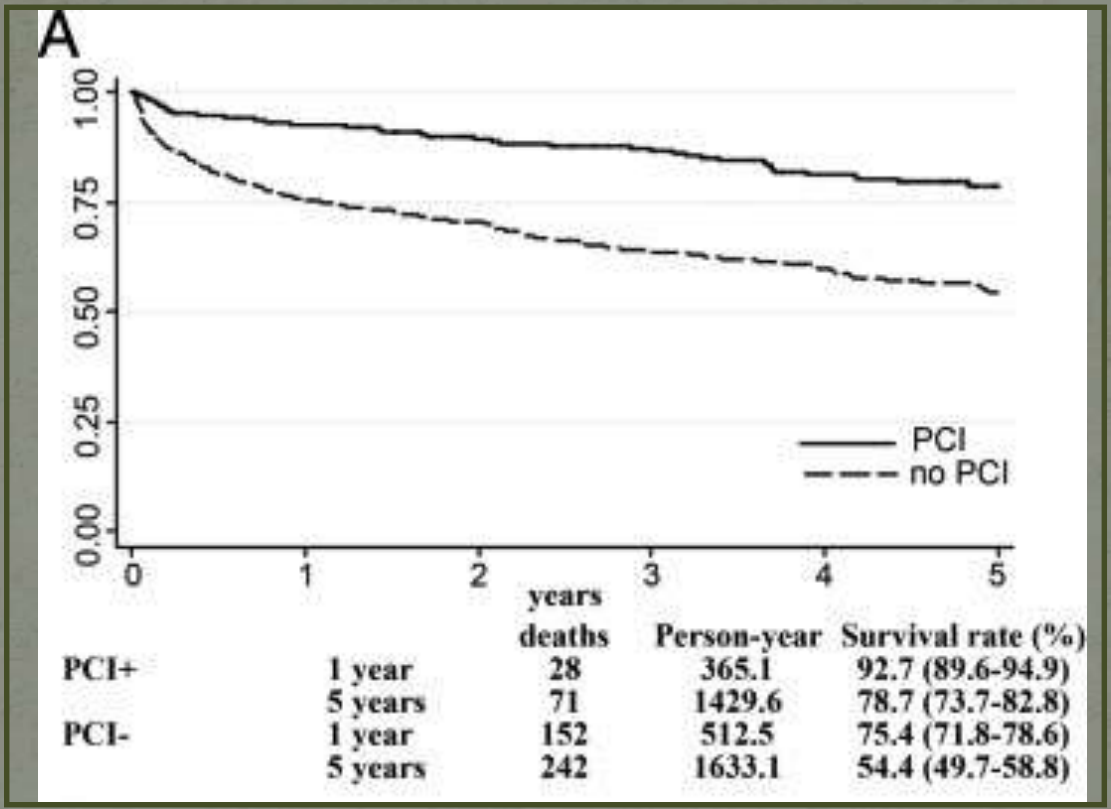
- **Therapeutic hypothermia**
- Careful hemodynamic management
- Coronary intervention if STEMI or high probability of coronary cause
- Neurology consultation and assessment

Long-term prognosis following resuscitation from out of hospital cardiac arrest

- Improved 5 yr survival for those who received PCI
  - 78% vs 54%
- Improved 5 yr survival for those who received TH:
  - 77.5% vs 60%

Dumas et al: J Am Coll Cardiol 2012; 60:21-27

Survival curve according to PCI after OHCA



		deaths	Person-year	Survival rate (%)
PCI+	1 year	28	365.1	92.7 (89.6-94.9)
	5 years	71	1429.6	78.7 (73.7-82.8)
PCI-	1 year	152	512.5	75.4 (71.8-78.6)
	5 years	242	1633.1	54.4 (49.7-58.8)

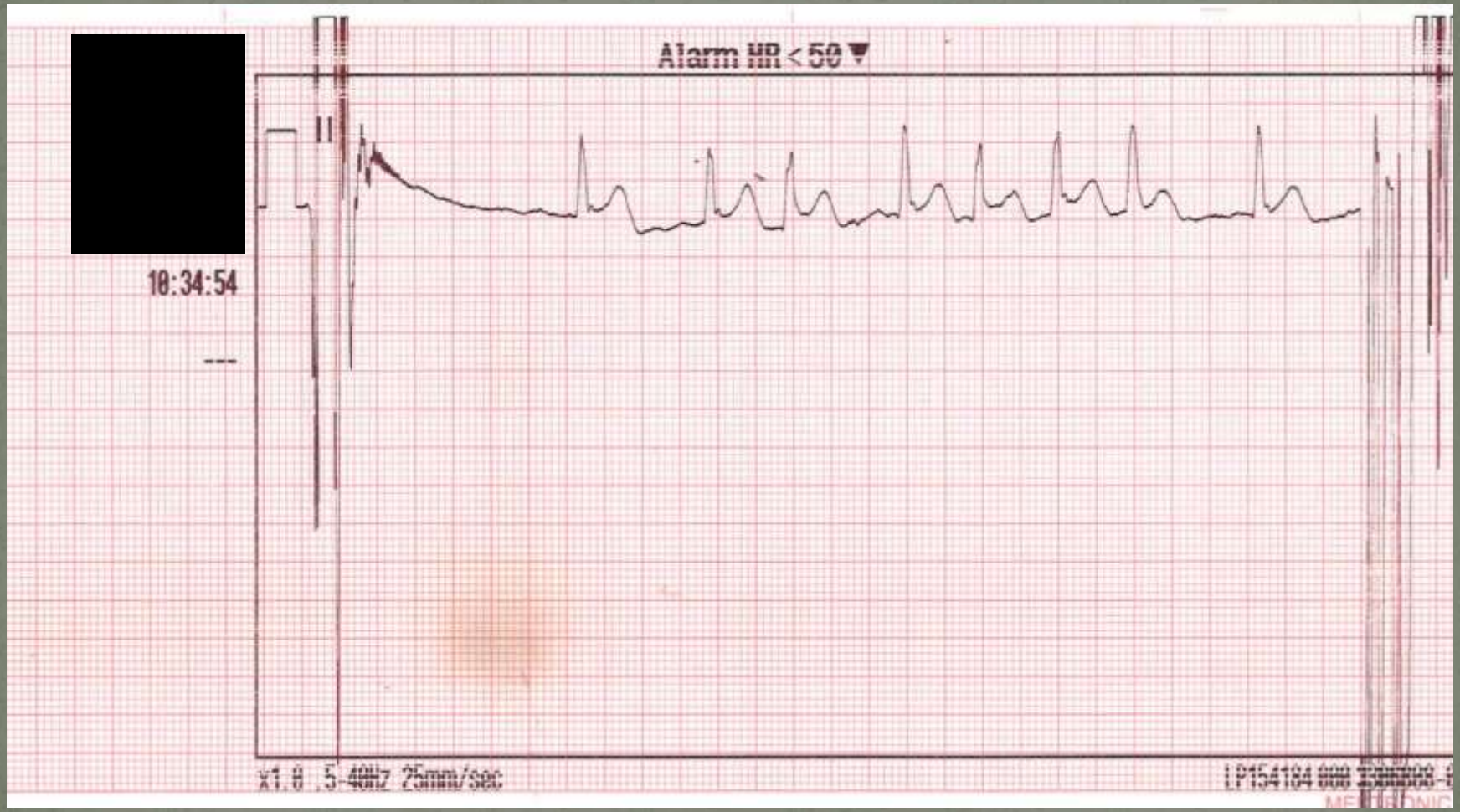
Dumas et al: J Am Coll Cardiol 2012; 60:21-27

59/Ch/Male

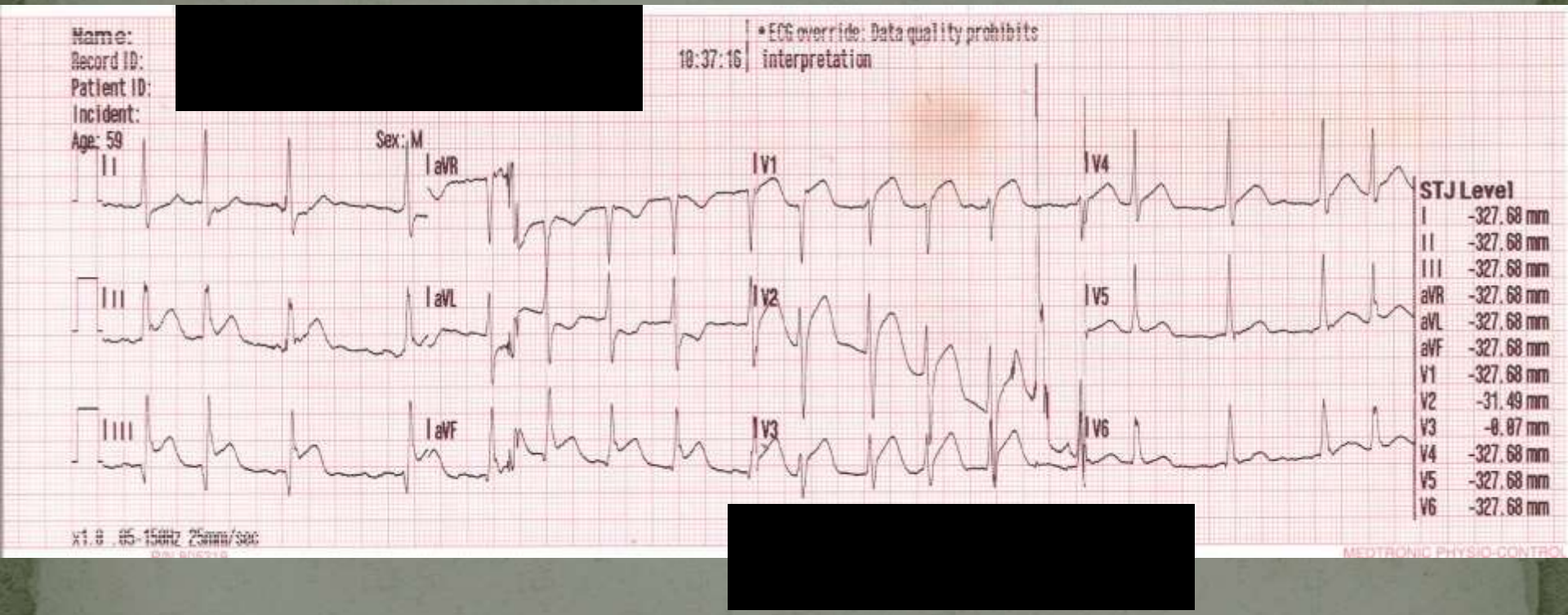
- C/O Chest pain
- Drives to GP Clinic
- GP dials 995

The paramedics arrive…

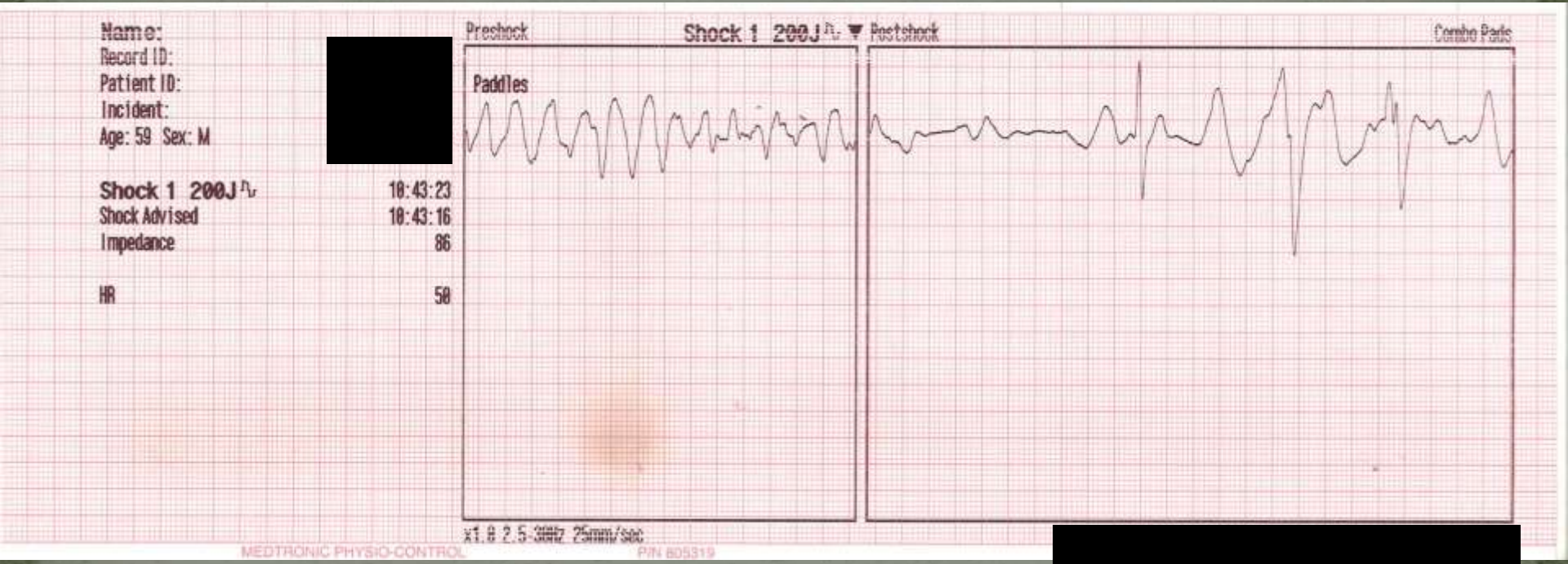
1034hrs: Initial rhythm



1037hrs: Prehosp 12-lead ECG

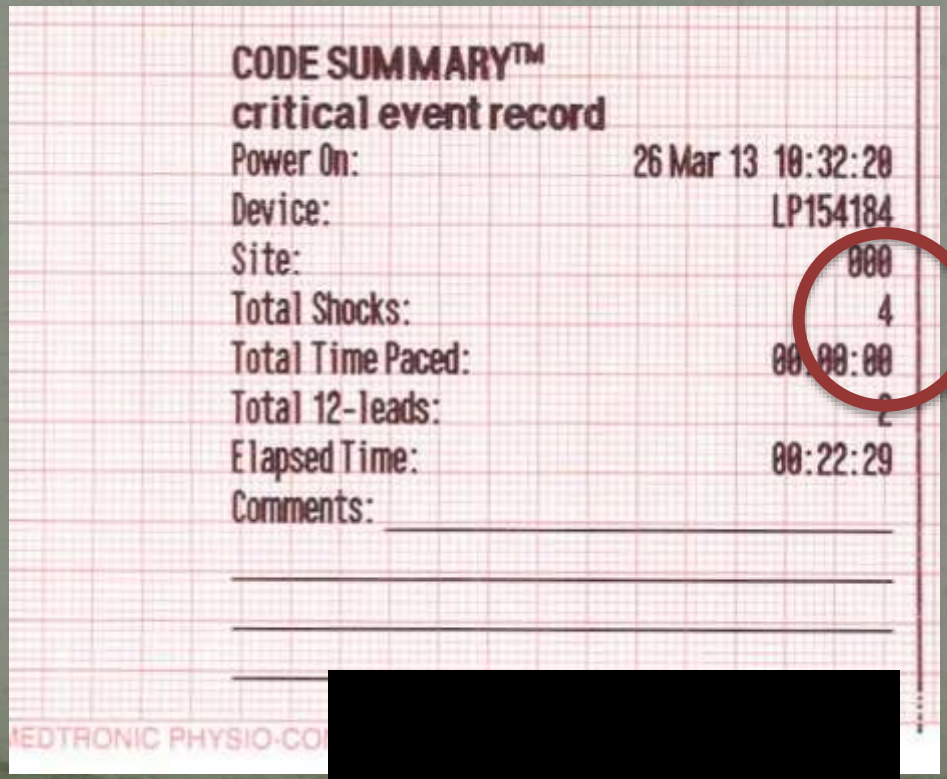


1043hrs: Whilst loading onto ambulance



Manual CPR + 4 shocks

10:53:44	Analysis 4	---
10:53:50	Shock Advised	---
10:54:01	Shock 4 360J	42



CODE SUMMARY™
critical event record

Power On:	26 Mar 13 10:32:20
Device:	LP154184
Site:	000
Total Shocks:	4
Total Time Paced:	00:00:00
Total 12-leads:	2
Elapsed Time:	00:22:29

Comments: _____

_____

_____

_____

MEDTRONIC PHYSIO-CO

1056hrs: Arrives at ED…

- Mechanical CPR
- ETT
- 7 Shocks
- IV adrenaline
- IV amiodarone
- Intermittent ROSC (last 1120hrs)
- IV Dopamine
- GCS 3
- Occ breaths

- And he is not stable…

Hello…?

- I’ve got a pt with ROSC from OHCA due to STEMI….

- I know he’s not really stable but….

“OK”

1st ever in NUH!

Transported with mech CPR en route to Cath Lab

1140hrs ROSC again

1155hrs balloon…

Over to CCU

- TH protocol started

Temperature

ECG


I
aVR
V1
II
aVL
V2
V5
III
aVF
V3
V6
II
20 Hz
25.0 mm/s
10.0 mm/mV
4 by 2.5s + 1 rhythm ld
MAC55 009C
12SL™v239

Day 3

- Extubated
- Talking
- C/O soreness on chest (CPR)
- Knows his name and address
- Knows his wife!
- Discharged Day 7

Wise quote to end the lecture

You miss one hundred percent of the shots you don't take.

Wayne Gretzky

16/1/1983