

North of England Intensive Care Society Spring Meeting 2011

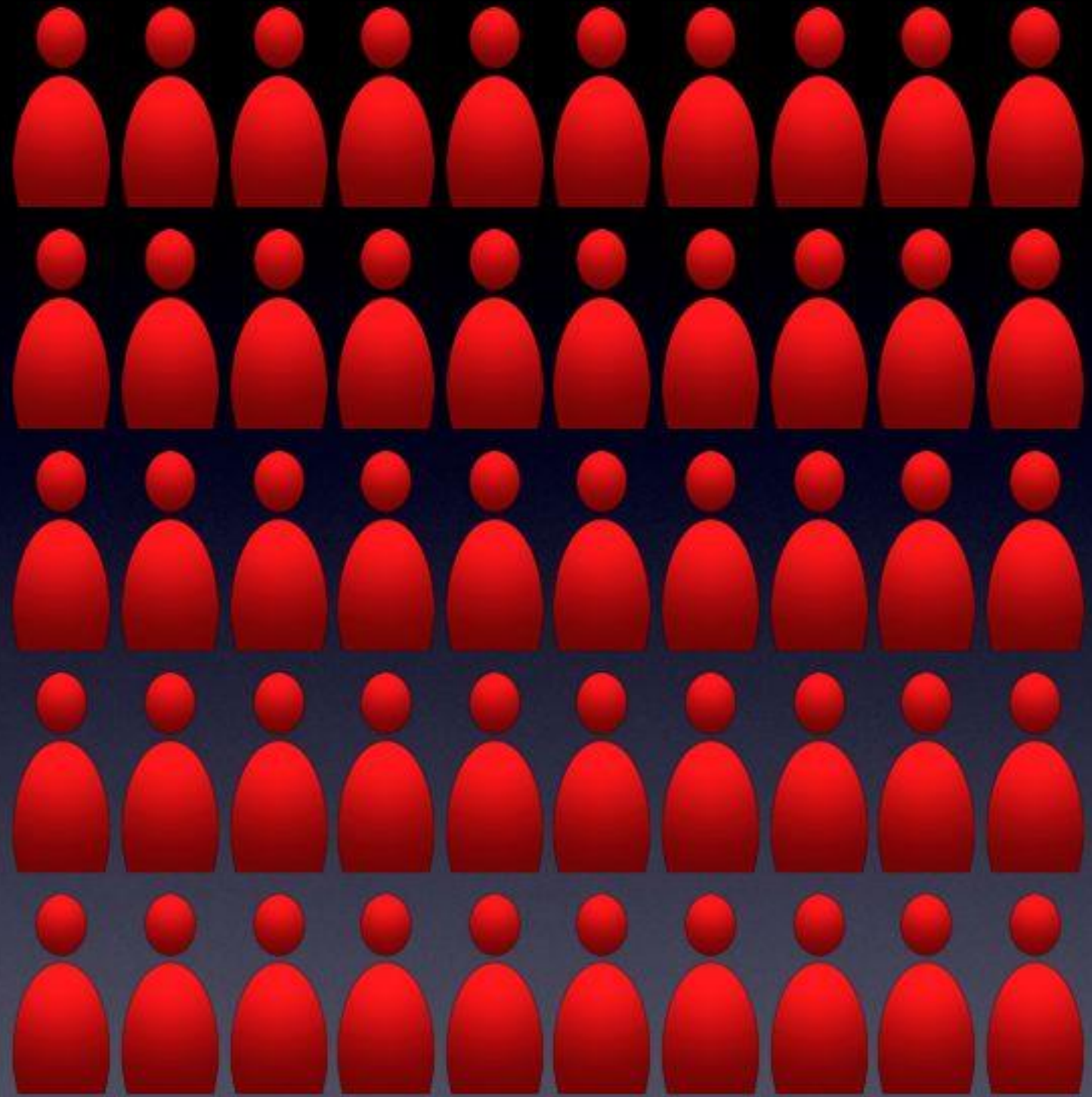
Temperature post cardiac arrest - The TOPCAT study

Dr Gareth Clegg

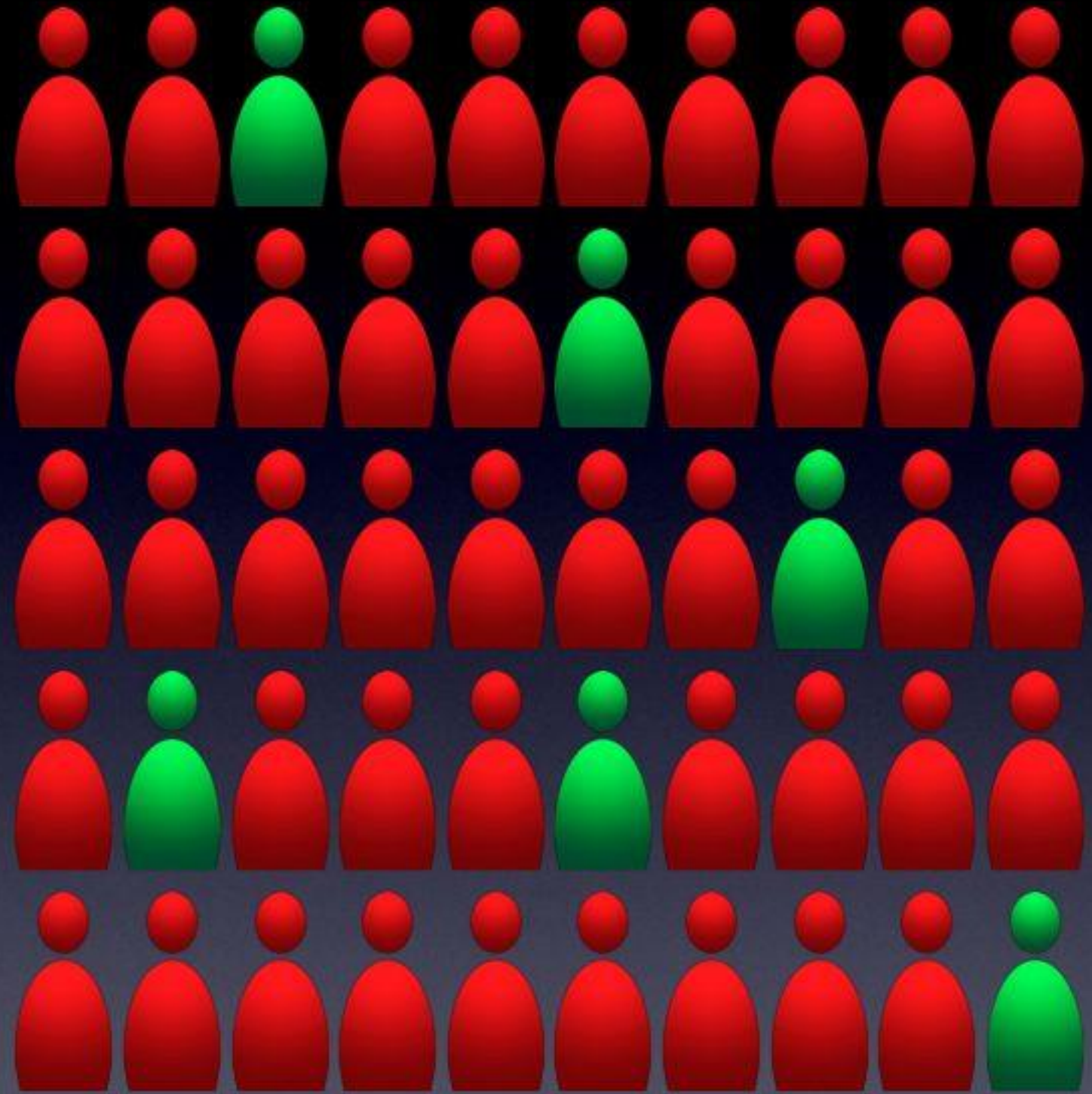
Senior Lecturer and Consultant in Emergency Medicine



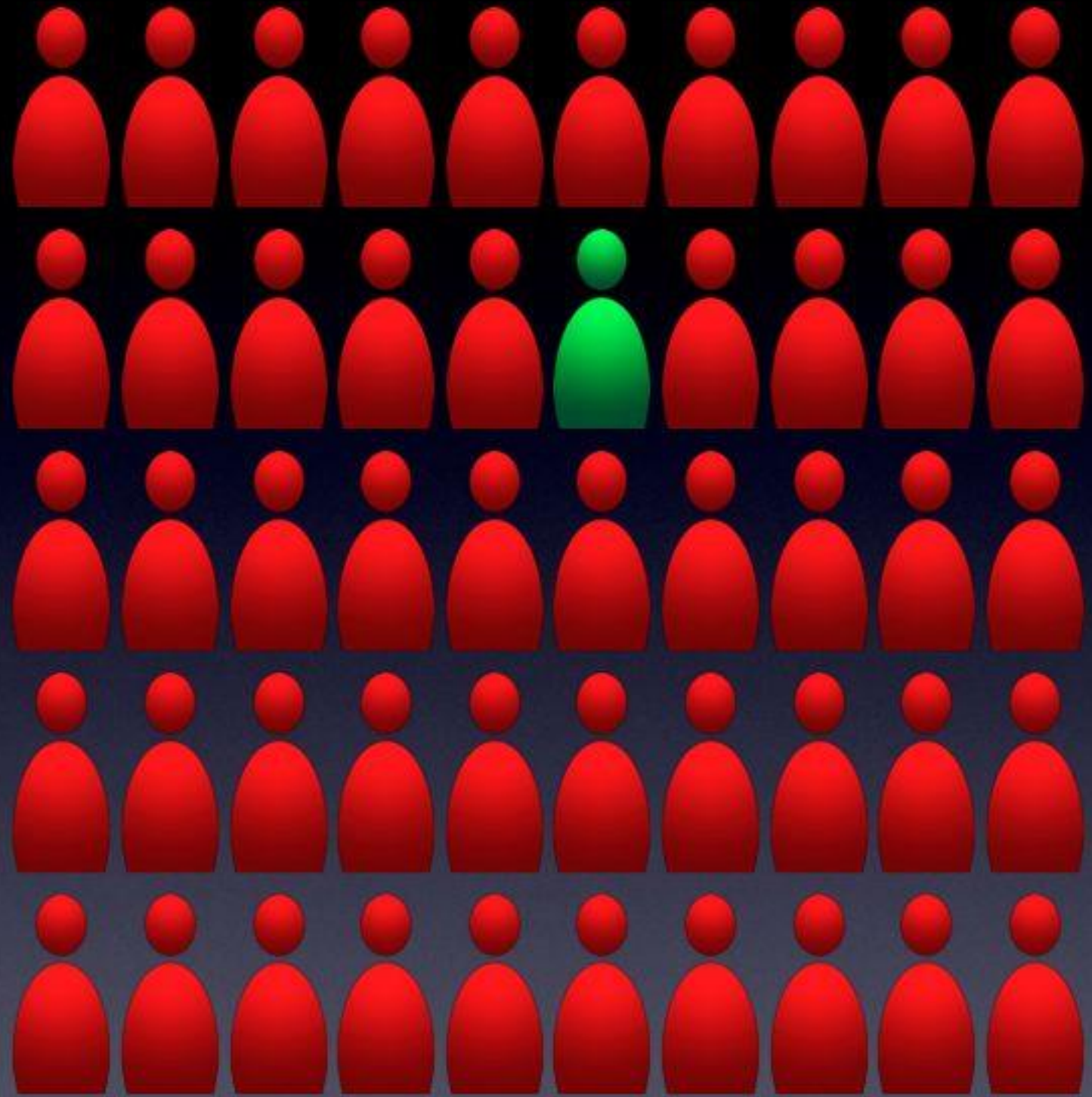




50 Scots hearts will stop



6 will make it to hospital



1 will make it home alive

Heartstart Data showing survival from all OHCA in SE Scotland 1992 - 2007

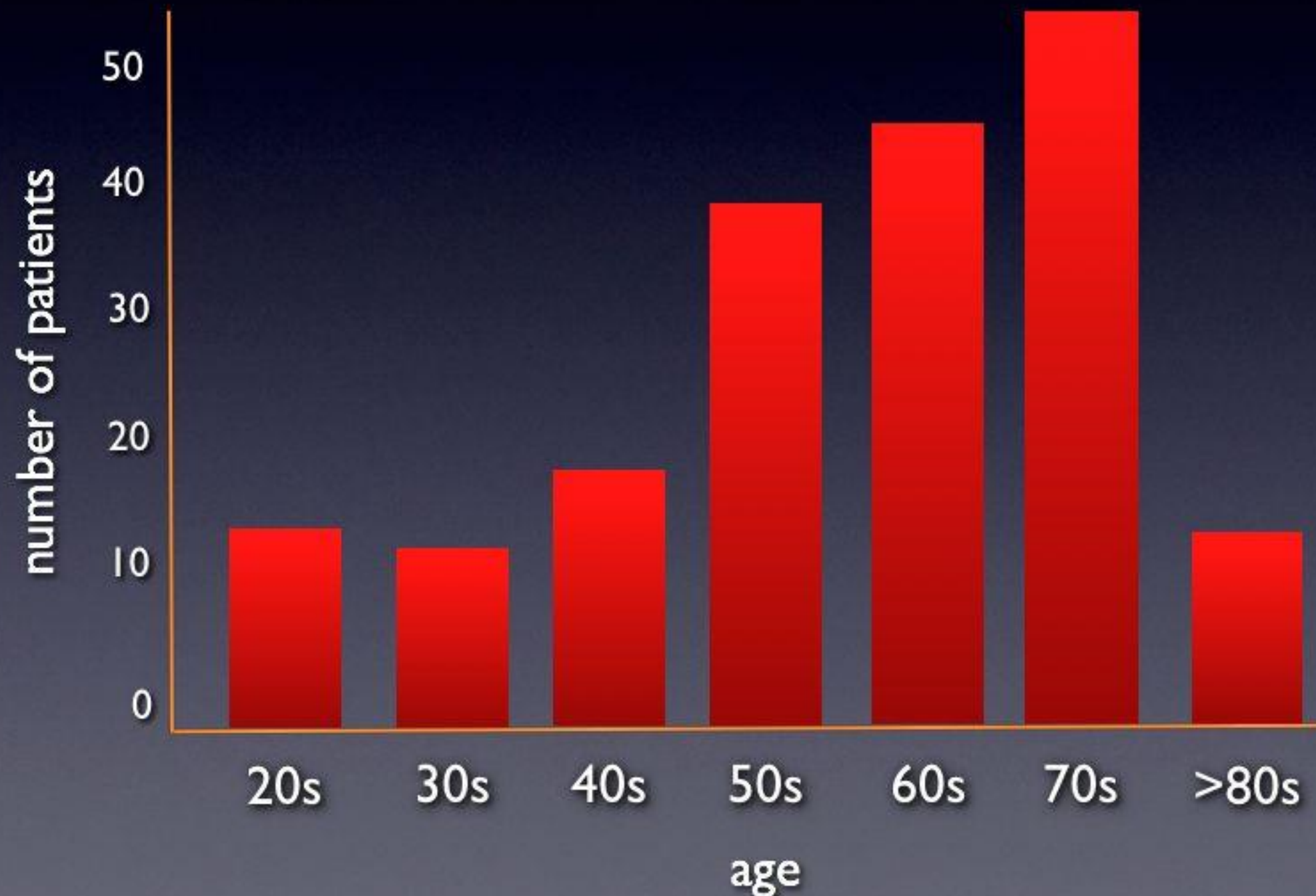


A black and white photograph showing the soles of two feet. A white identification tag is hanging from the left foot by a thin white string. The tag contains the following text: Name: John Doe, DOD: 02/04/09, Cause: Cardiac Arrest.

Name: John Doe
DOD: 02/04/09
Cause: Cardiac Arrest

“They all die anyway, don’t they?..”

Age distribution of OHCA in Edinburgh from Aug 2008 to Jan 2010



Regional Variation in Out-of-Hospital Cardiac Arrest Incidence and Outcome

Graham Nichol; Elizabeth Thomas; Clifton W. Callaway; et al.

Table 4. Incidence and Outcome of EMS-Treated Out-of-Hospital Cardiac Arrest^a

	Alabama (n = 267)	Dallas (n = 1265)	Iowa (n = 565)	Milwaukee (n = 801)	Ottawa (n = 1836)	Pittsburgh (n = 575)	Portland (n = 793)	Seattle (n = 1170)	Toronto (n = 2992)	Vancouver (n = 1634)	Overall (n = 11 898)
Adjusted incidence rate per 100 000	40.3	82.9	51.3	86.7	45.1	51.1	47.0	74.4	57.0	52.8	56.0
Adjusted mortality rate per 100 000	36.9	77.2	44.4	78.0	42.3	47.1	41.0	62.3	53.6	46.9	50.9
Case-fatality rate, %	91.7	92.6	86.9	90.1	93.5	92.3	86.8	83.5	93.8	88.5	90.7
Survival to discharge, %	3.0	4.5	11.0	9.7	5.3	7.0	10.6	16.3	5.5	9.7	7.9
Vital status data missing, %	5.3	2.9	2.1	0.1	1.2	0.7	2.5	0.2	0.7	1.7	1.4

Abbreviation: EMS, emergency medical services.

^aAll rates were unequal across sites at $P < .001$.

Table 5. Incidence and Outcome of Ventricular Fibrillation^a

	Alabama (n = 65)	Dallas (n = 195)	Iowa (n = 135)	Milwaukee (n = 165)	Ottawa (n = 429)	Pittsburgh (n = 102)	Portland (n = 249)	Seattle (n = 297)	Toronto (n = 614)	Vancouver (n = 478)	Overall (n = 2729)
Adjusted incidence rate per 100 000	9.9	12.8	12.4	18.7	10.4	9.3	15.1	19.0	11.4	15.2	12.8
Adjusted mortality rate per 100 000	8.8	10.7	8.9	13.7	8.6	7.2	11.3	11.5	9.5	10.9	9.8
Case-fatality rate, %	89.2	82.7	72.9	74.0	83.1	77.5	73.9	59.8	83.0	71.7	76.5
Survival to discharge, %	7.7	9.5	22.7	26.0	14.8	21.5	22.5	39.9	15.7	25.0	21.0
Vital status data missing, %	3.1	7.9	4.4	0	2.1	1.0	3.6	0.3	1.3	3.3	2.5

^aAll rates were unequal across sites at $P < .001$.



Incidence of EMS-treated out-of-hospital cardiac arrest in Europe[☆]

Christie Atwood^a, Mickey S. Eisenberg^{b,c,*}, Johan Herlitz^d, Thomas D. Rea^{b,c}

Table 1

Incidence of EMS-treated all-rhythm and ventricular fibrillation cardiac arrest

Community	Population served	Person-years	All-rhythm arrests	All-rhythm incidence	All-rhythm survivors	Survival (%)	VF arrests	VF incidence	VF survivors	Survival (%)
West Yorkshire, UK ^a	2,200,000	5,874,000	1196	20.36	65	5.4	456	7.76	64	14.0
Lombardia region, Italy	2,013,774	503,444	178	35.36	10 ^b	5.6	38	7.55	6 ^b	15.8
Vienna, Austria ^a	1,508,120	1,508,120	249	16.51	27	10.8	117	7.76	24	20.5
Amsterdam, Netherlands	1,300,000	2,821,000	1046	37.08	134	12.8	631	22.37	—	—
Nottinghamshire, UK	1,000,000	4,000,000	1547	38.68	94	6.1	728	18.20	85	11.7
Friuli Venezia Giulia region, Italy	940,088	940,088	344	36.59	23	6.7	104	11.06	—	—
Leicestershire, UK	900,000	900,000	159	17.67	19	12.0	85	9.44	19	22.4
Nottingham, UK ^a	800,000	936,000	51	5.45	3	5.9	—	—	—	—
Edinburgh, Scotland ^a	750,000	750,000	297	39.60	39	13.1	160	21.33	37	23.1
Norfolk, UK	600,000	600,000	147	24.50	11	7.5	67	11.17	—	—
Rotterdam, Netherlands ^a	598,694	4,190,858	898	21.43	276	30.7	603	14.39	234	38.8
St-Exteme, France	371,191	371,191	113	19.78	8	7.1	43	7.88	8	17.8
Helsinki, Finland	516,000	516,000	255	49.42	50	19.6	126	24.42	41	32.5
Oslo, Norway	500,000	1,000,000	328	32.8	33	10.1	166	16.60	—	—
Copenhagen, Denmark	465,000	1,395,000	703	50.39	82	11.7	414	29.68	74	17.9
Göteborg, Sweden	462,470	8,749,932	3871	44.24	340	8.8	1545	17.66	—	—
Bochum, Germany	410,000	479,700	197	41.07	—	—	—	—	—	—
South Glamorgan, UK	407,300	1,071,199	712	66.47	45	6.3	264	24.65	43	16.3
Ljubljana, Slovenia	397,306	1,191,918	337	28.27	19	5.6	120	10.07	15	12.5
Katowice, Poland	338,000	338,000	147	43.49	15	10.20	74	21.89	—	—
Heidelberg, Germany	330,000	9,900,000	338	34.14	48	14.2	106	10.71	36	34.0
Stavanger, Norway	273,000	1,092,000	526	48.17	104	19.8	269	24.63	—	—
Three units of Stockholm, Sweden ^a	257,000	257,000	307	119.46	11	3.6	140	54.47	9	6.4
Ostfold, Norway	246,000	738,000	353	47.83	40	11.3	154	20.87	—	—
Bonn, Germany	240,000	960,000	464	48.33	74	16.0	210	21.88	56	26.7
Gent, Belgium ^a	200,000	934,000	367	39.29	31	8.5	126	13.49	26	20.6
Glasgow, Scotland ^a	200,000	200,000	158	79.00	13	8.2	54	27.00	10	18.5
Akershus, Norway	197,250	789,000	241	30.54	30	12.5	140	17.74	—	—
Leiden area, Netherlands	196,193	686,676	309	45.00	42	13.6	200	29.13	40	20.0
Mainz, Germany	180,000	255,600	211	82.55	19	9.0	90	35.21	15	16.7
Piacenza region, Italy ^a	173,114	332,379	354	106.50	22	6.2	67	20.16	22	32.8
Trondheim region, Norway	154,000	770,000	442	57.40	52	11.8	255	33.12	48	18.8
Brugge, Belgium ^a	135,000	675,000	240	35.56	25	10.4	89	13.19	20	22.5
Tartu area, Estonia	100,000	600,000	248	41.33	13	5.2	72	12.00	—	—
Austrian alpine area	88,255	529,530	338	63.83	31	9.17	118	22.28	26	22.0
Stralsund, Germany	75,000	525,000	273	52.00	28	10.3	111	21.14	—	—
Bodo, Northern Norway	34,500	241,500	123	50.93	23	18.7	62	25.67	20	32.3

Incidence is reported per 100,000 person-years. Ventricular fibrillation is abbreviated VF.

^a Medical cardiac arrests.

^b Survival at 1 month.

Survival to discharge all-rhythms OHCA treated by EMS: best vs worst

		
Best	16.3%	30.7%
Worst	3%	3.6%
Fold difference	5	8.5

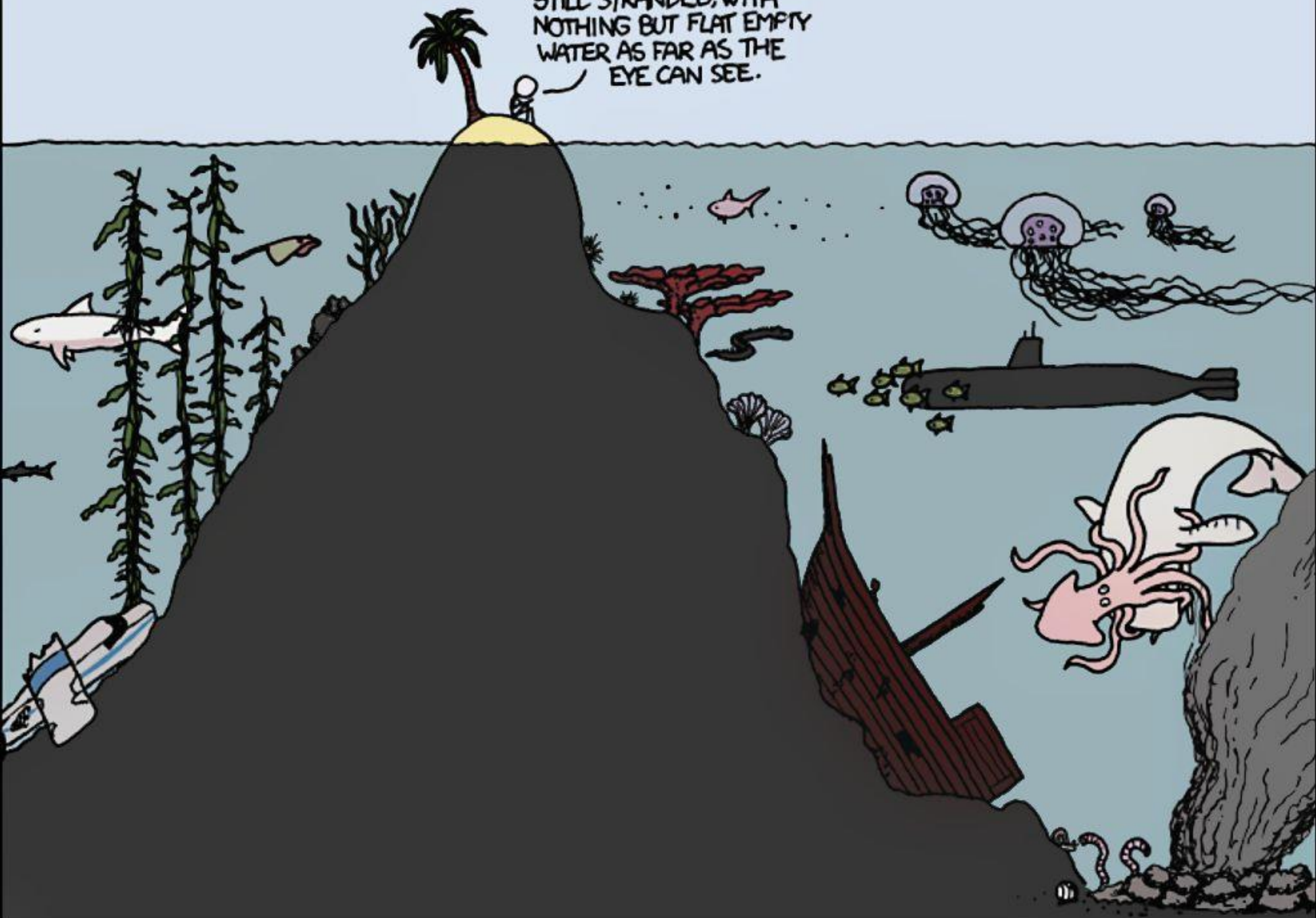
secret
ingredient?





A B C

DAY 44:
STILL STRANDED, WITH
NOTHING BUT FLAT EMPTY
WATER AS FAR AS THE
EYE CAN SEE.

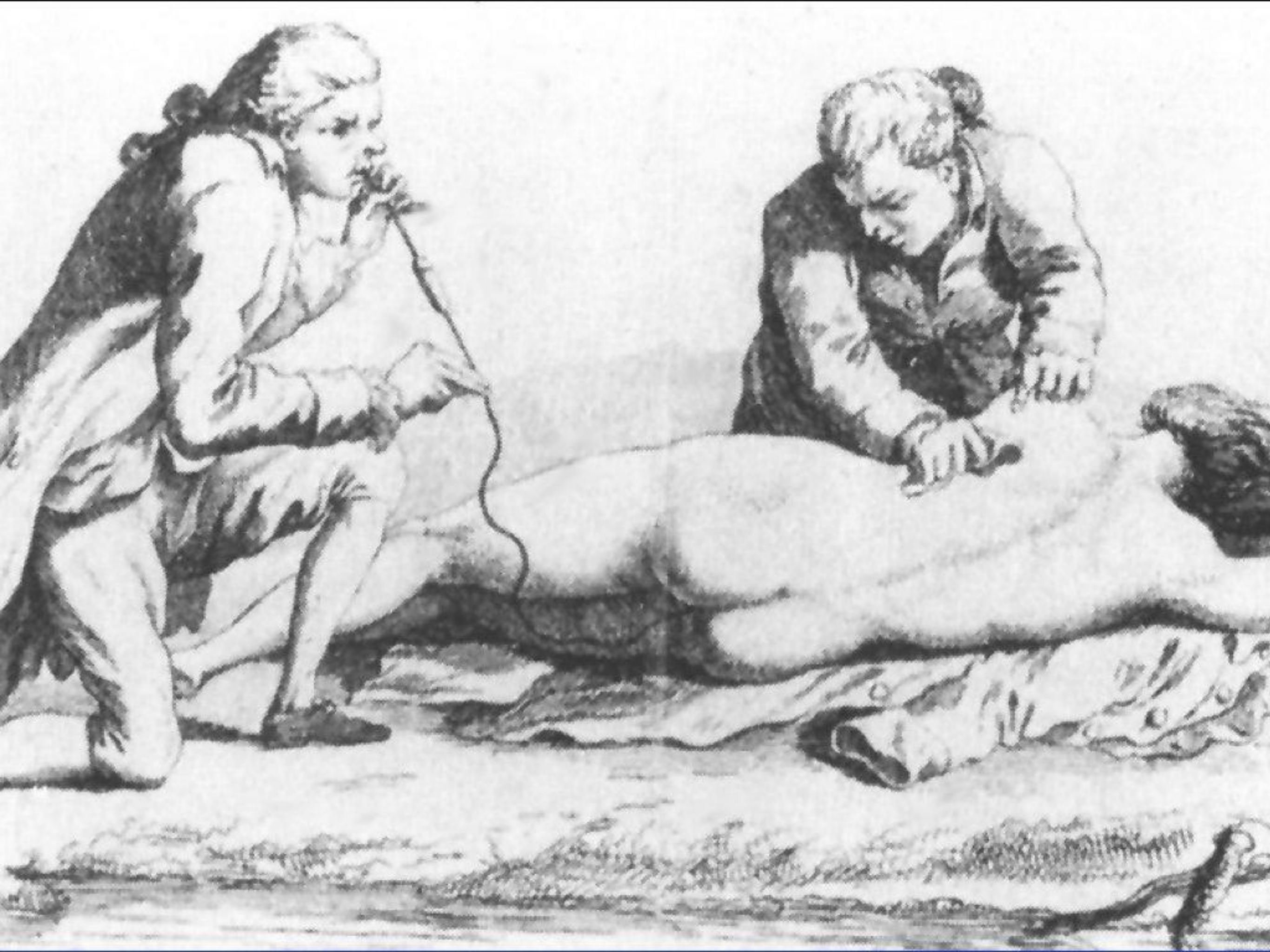






Improvement in survival after OHCA by optimising the chain of survival

	Before	After
All rhythms OHCA	7%	13%
VF arrest	13%	33%







CPR



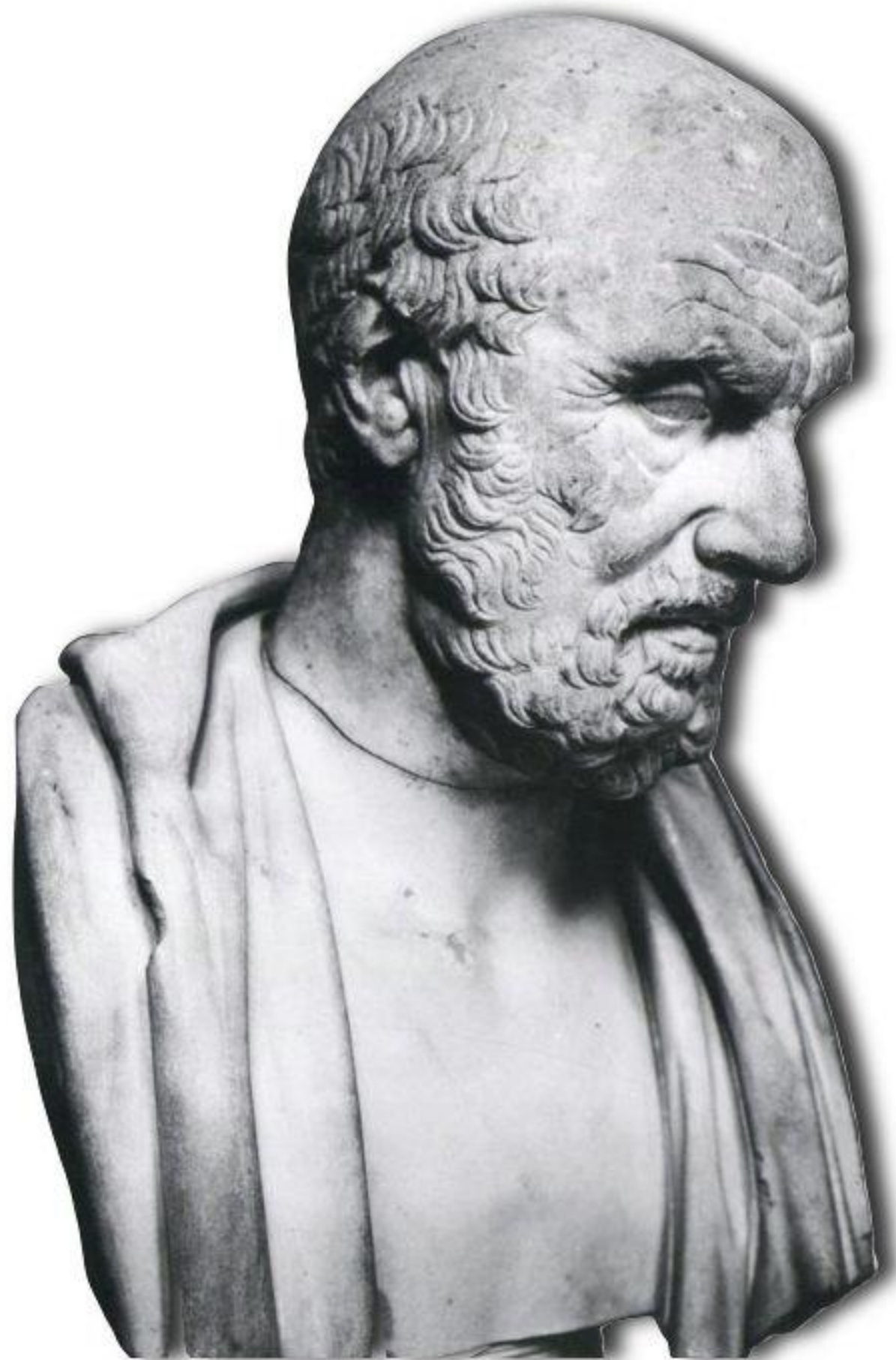
Defibrillation



MTH



MTH



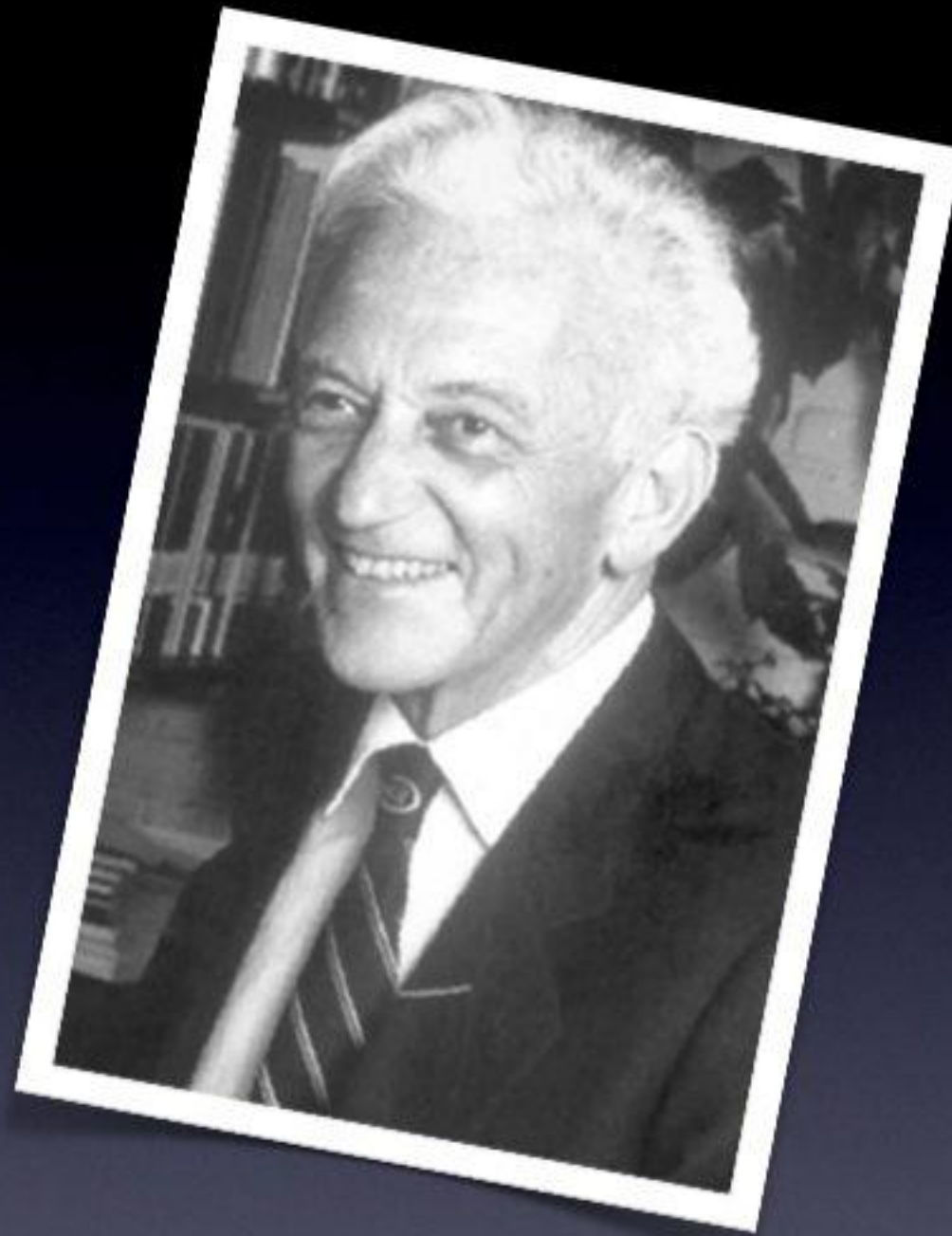
EXTREME REMEDIES

ARE VERY

APPROPRIATE FOR

EXTREME DISEASES.





‘brains too good to die’

Peter Safar

RCTs show that cooling patients with shockable rhythms post OHCA improves survival

Hypothermia after Cardiac Arrest Study Group. N Engl J Med (2002) vol. 346 (8) pp. 549-56

Bernard SA et al. N Engl J Med 346 (8) pp 557-63

Australian

43 patients

33°C for 12 hrs

NNT 4 Favourable outcome

NNT 6 Survival

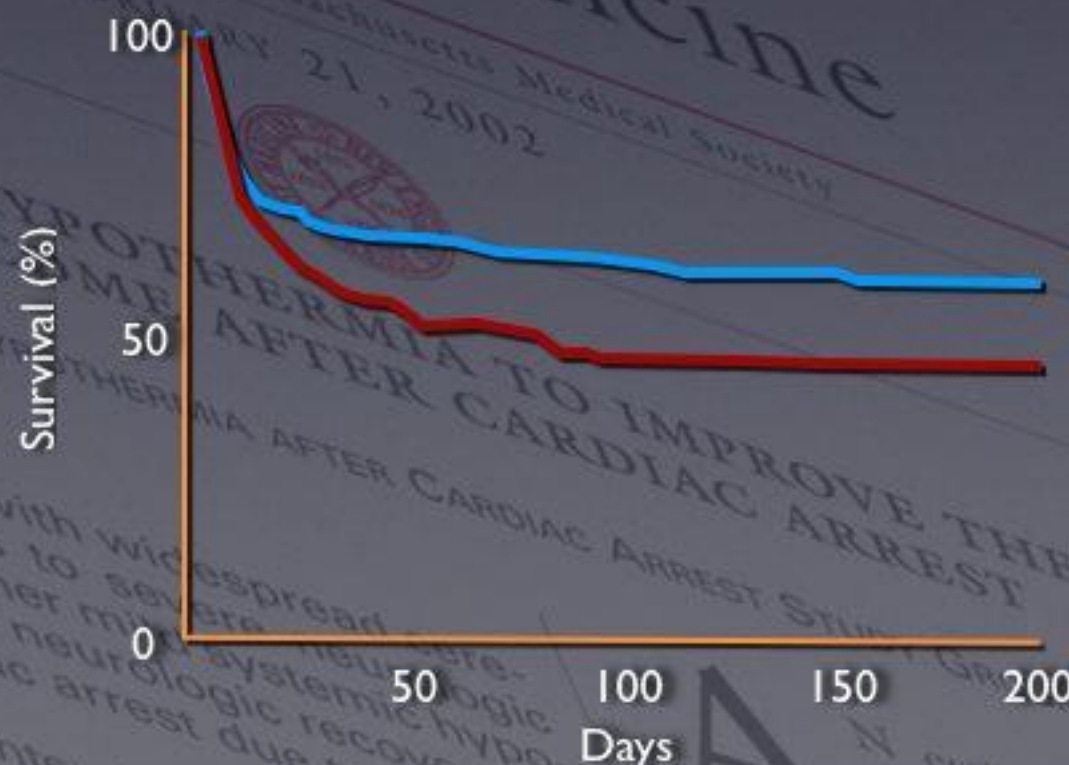
European

136 patients

32-34°C for 24 hrs

NNT 6 Favourable outcome

NNT 7 Survival



How quickly should we cool?

Where should we cool?

How quickly should we rewarm?

How cool should we go?

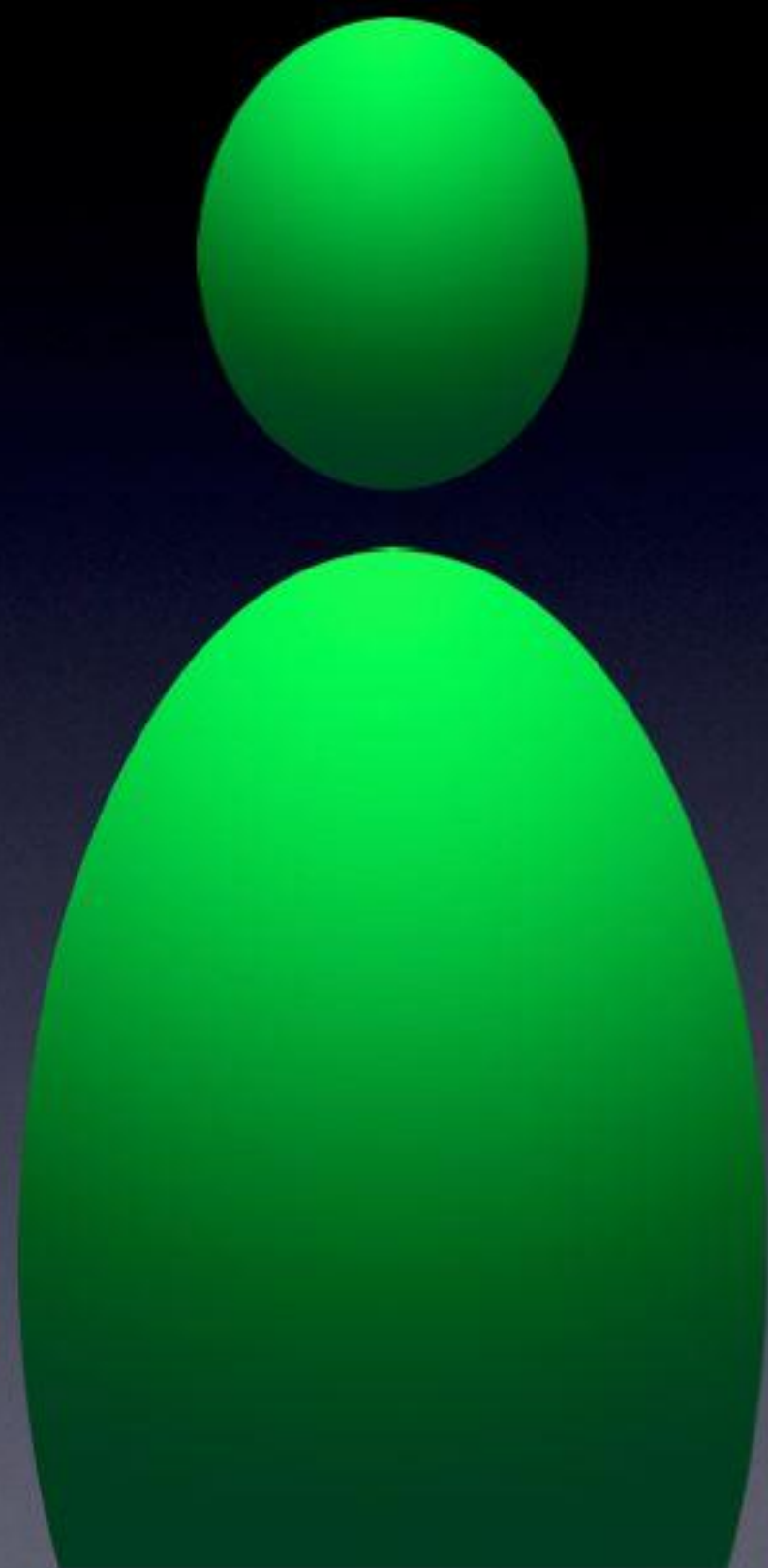
Cool for how long?

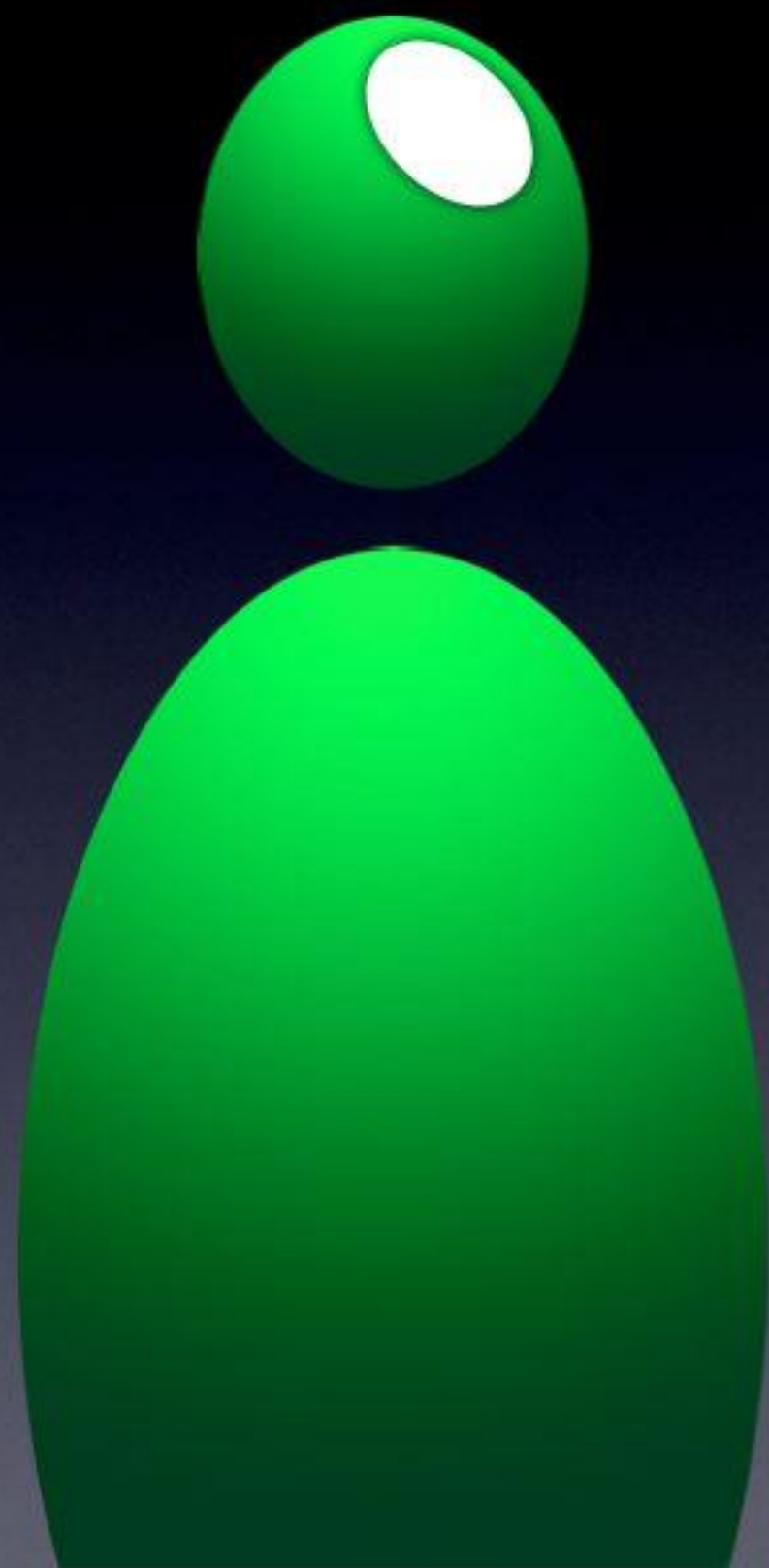
When should cooling start?

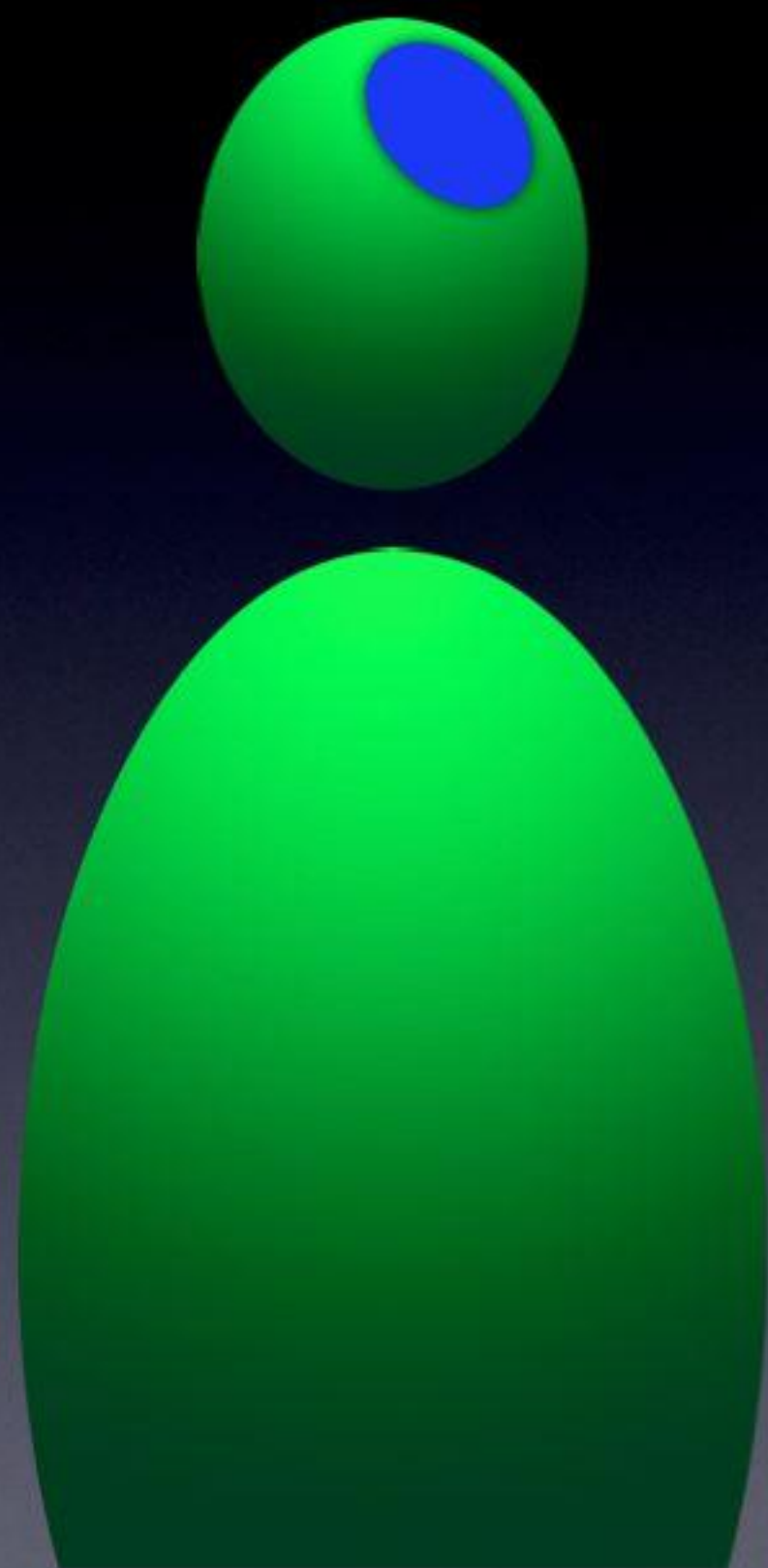
What cooling method?

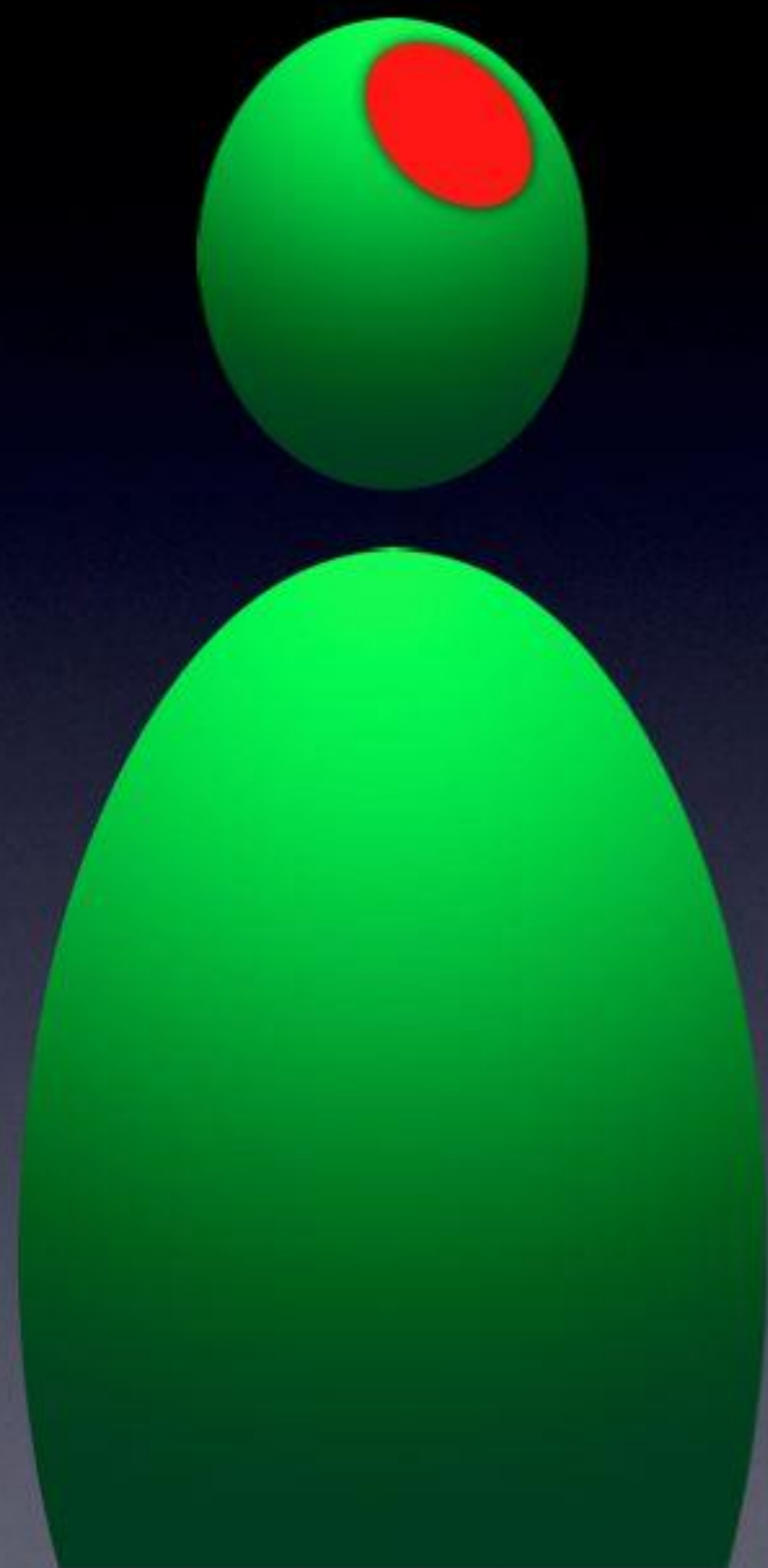
Why does it work?

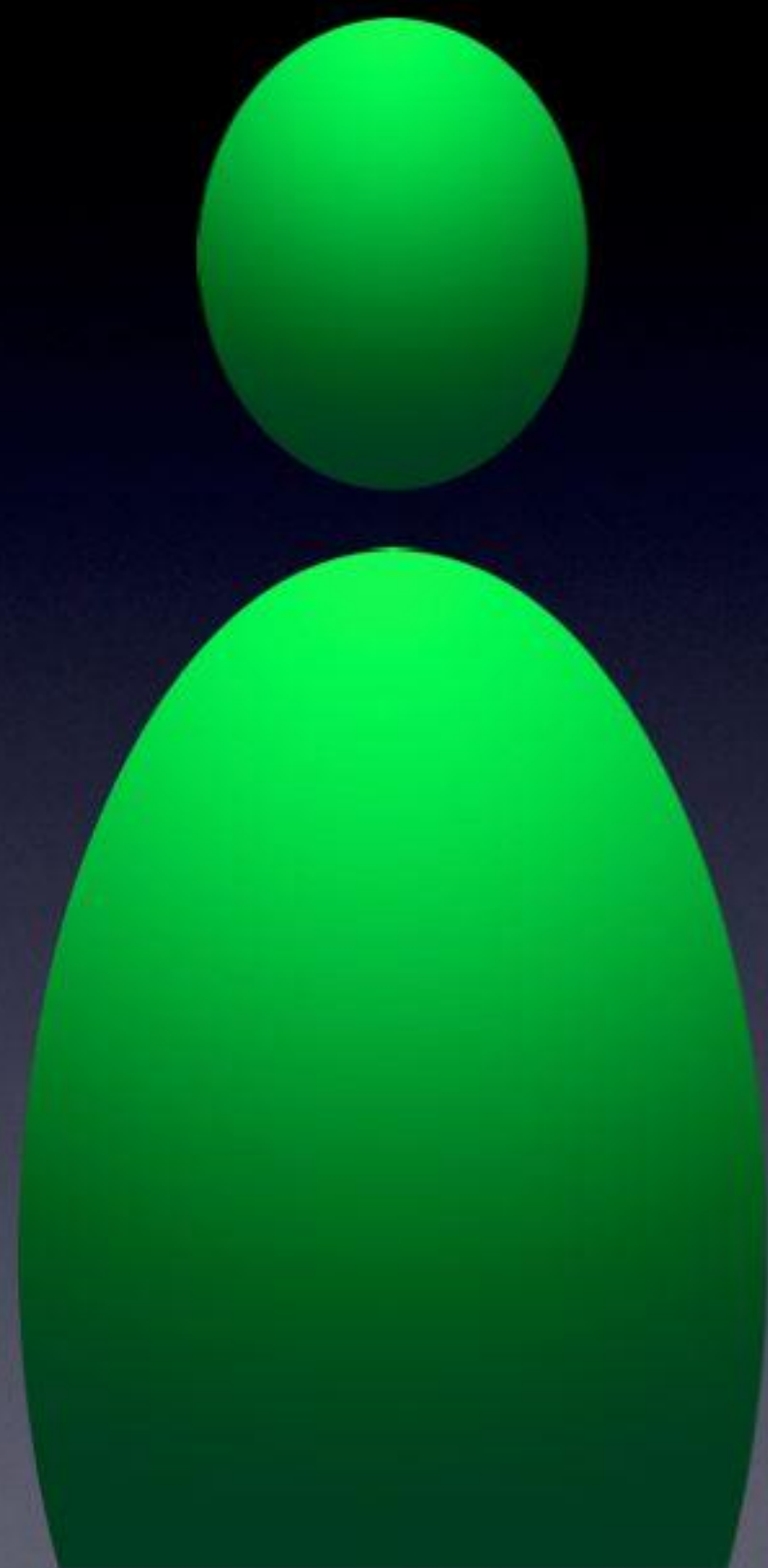
why does
it work?

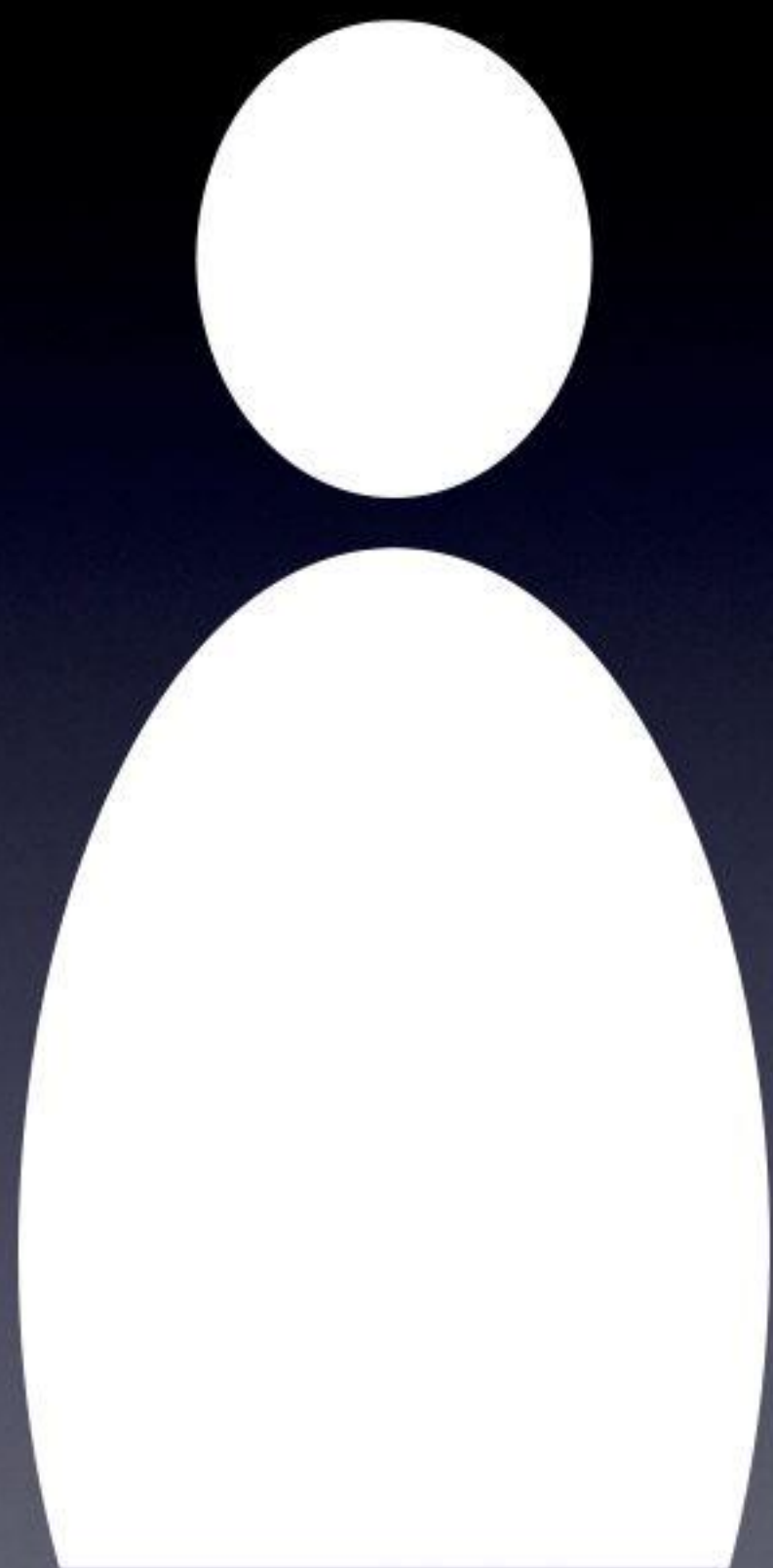


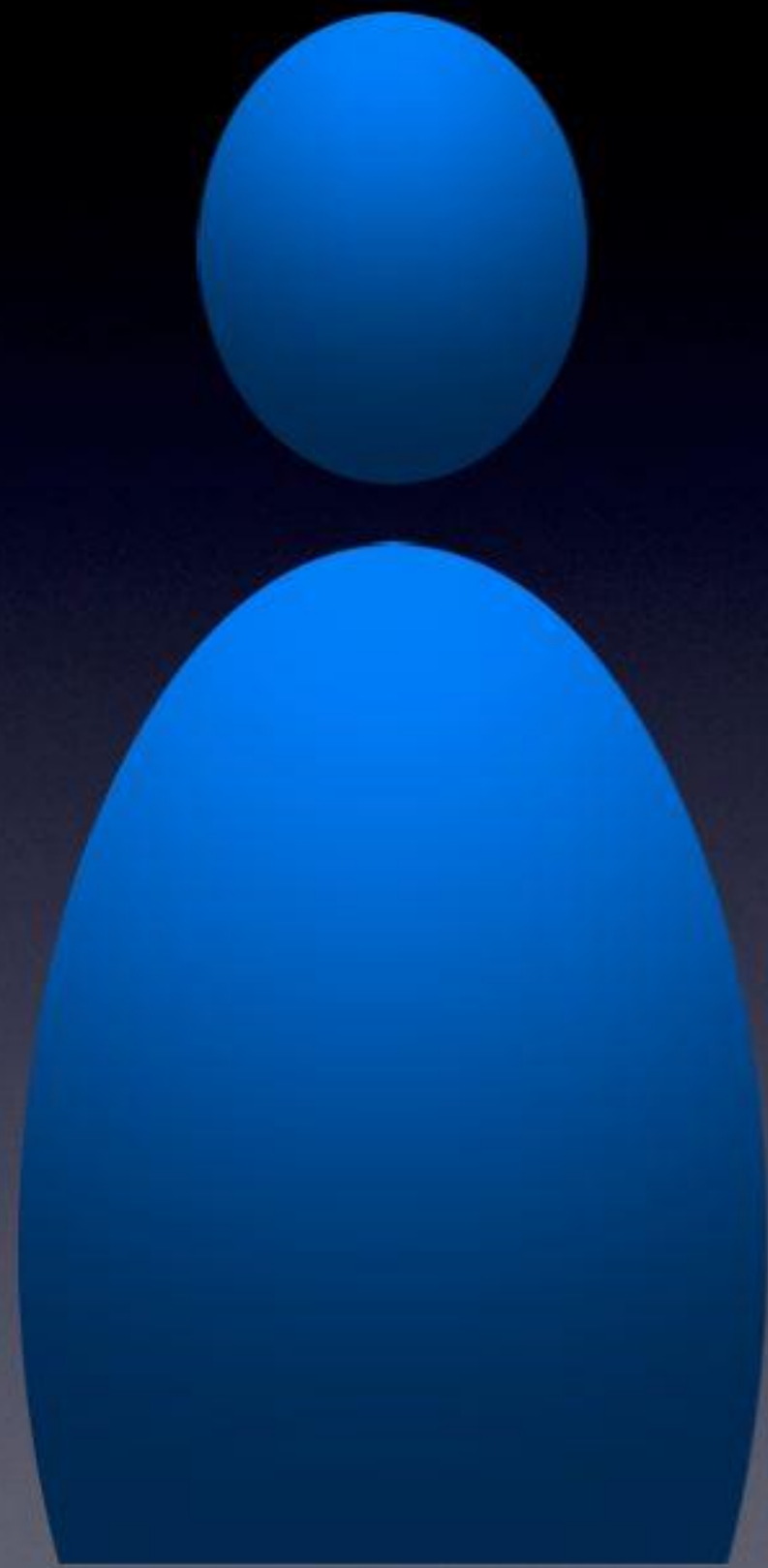


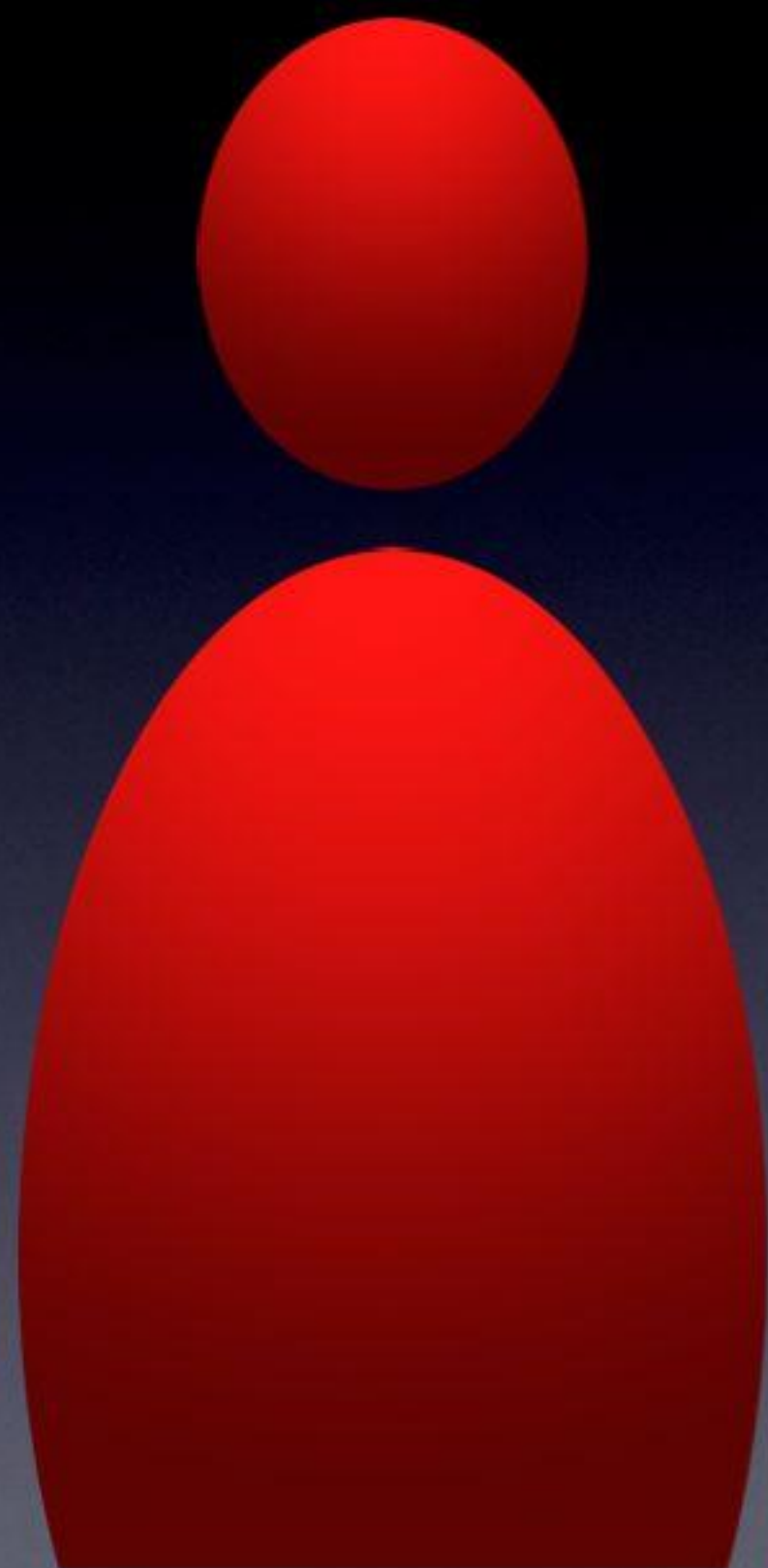




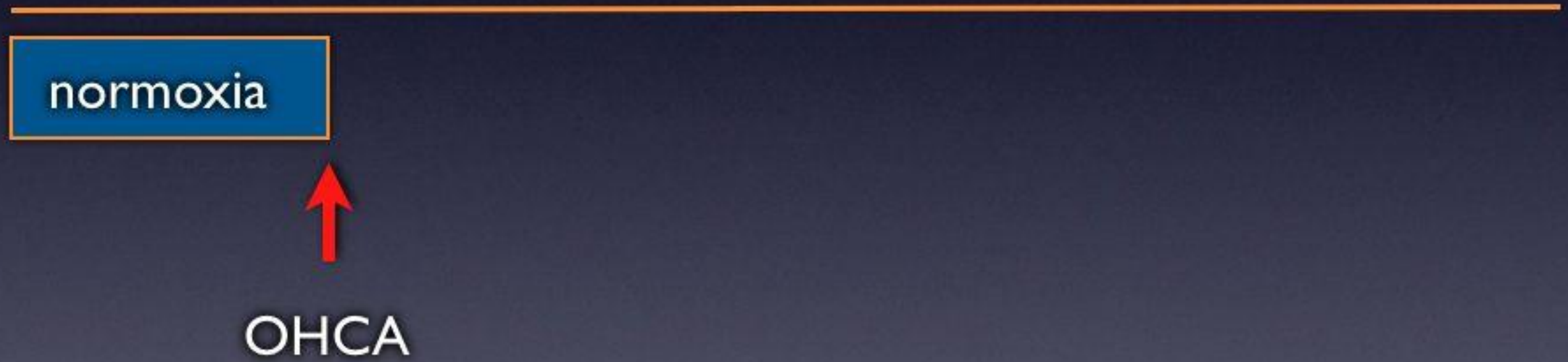




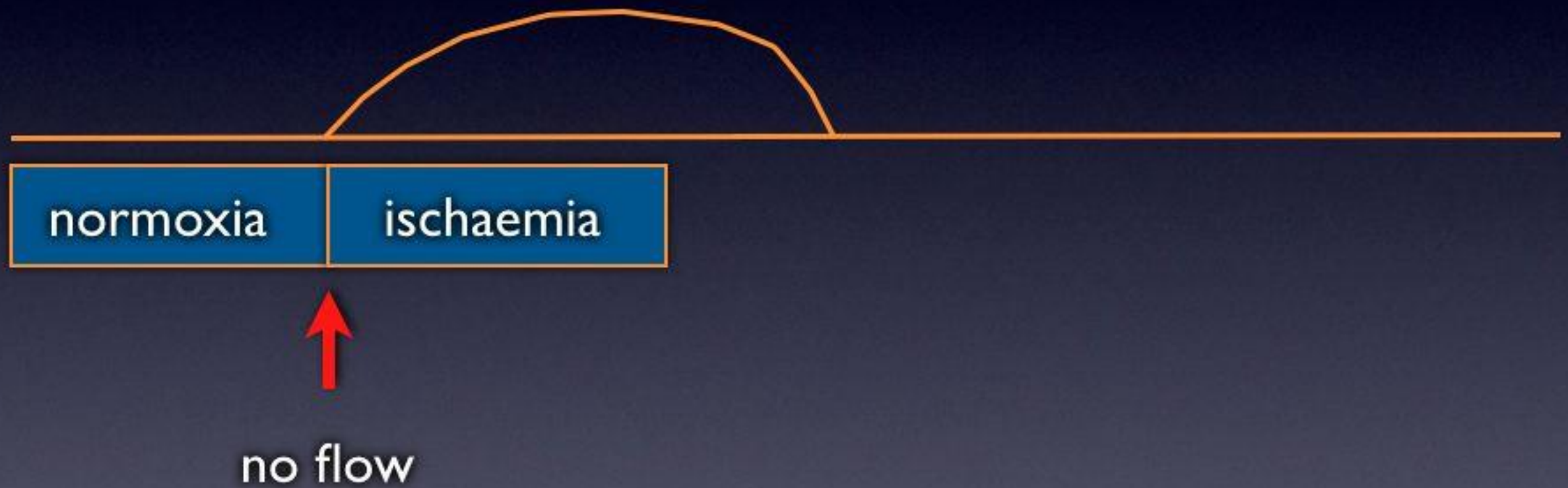


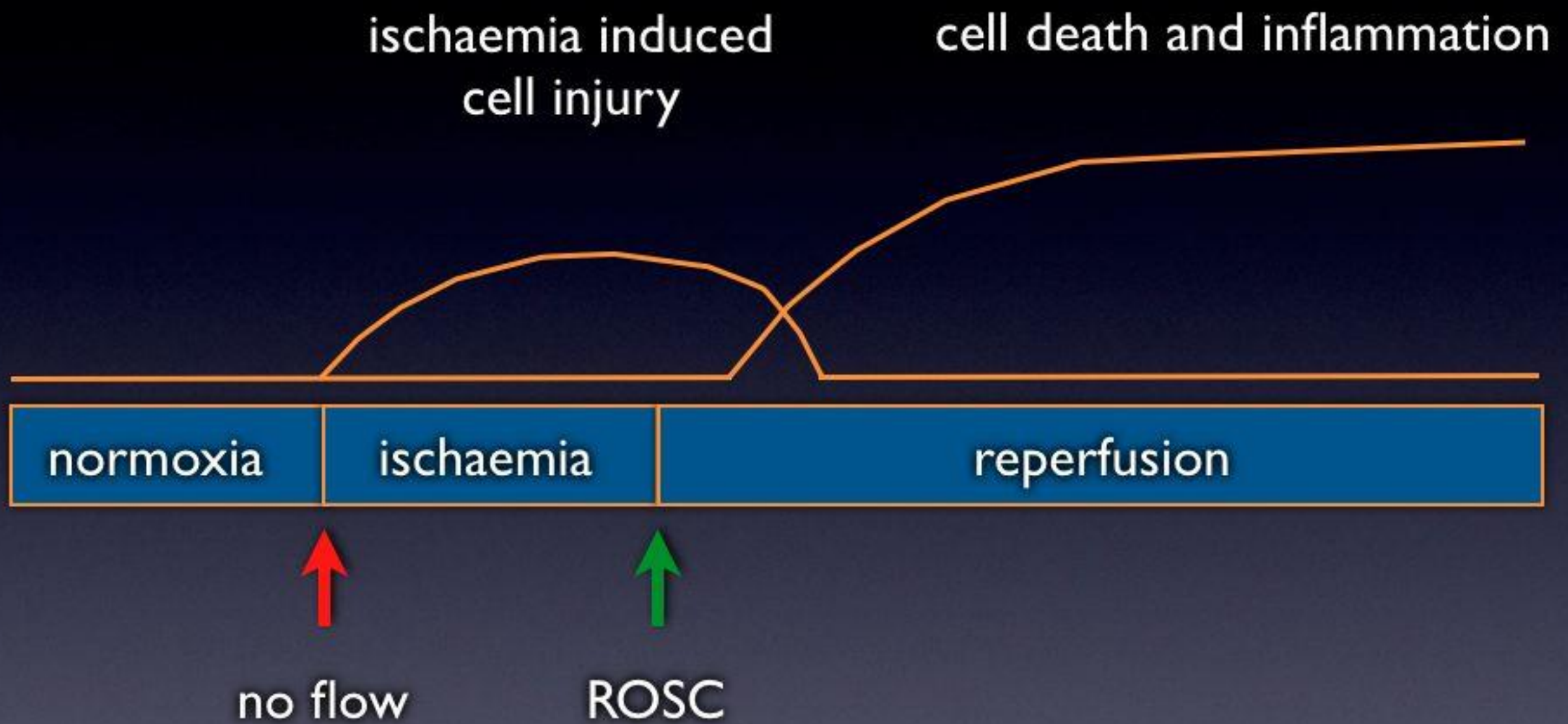


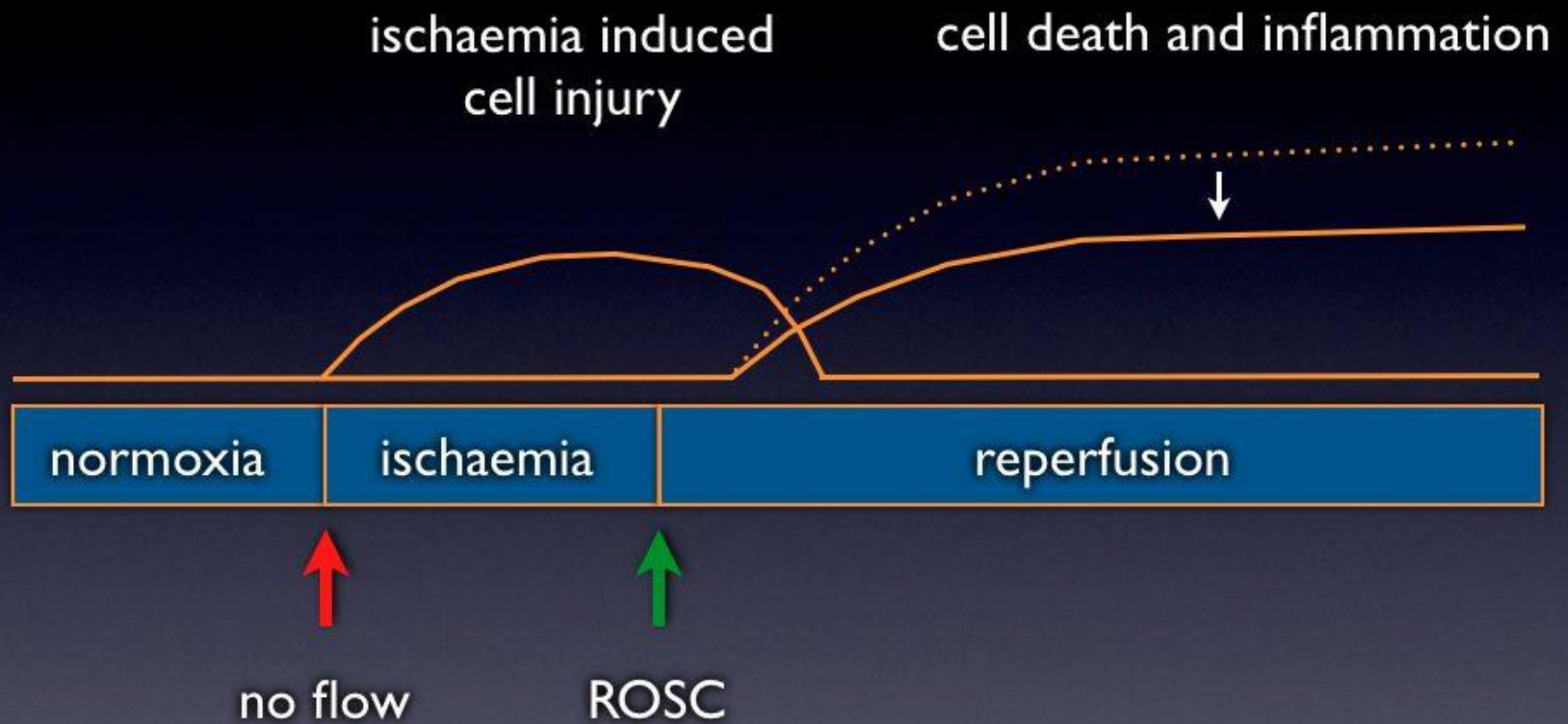
normoxia

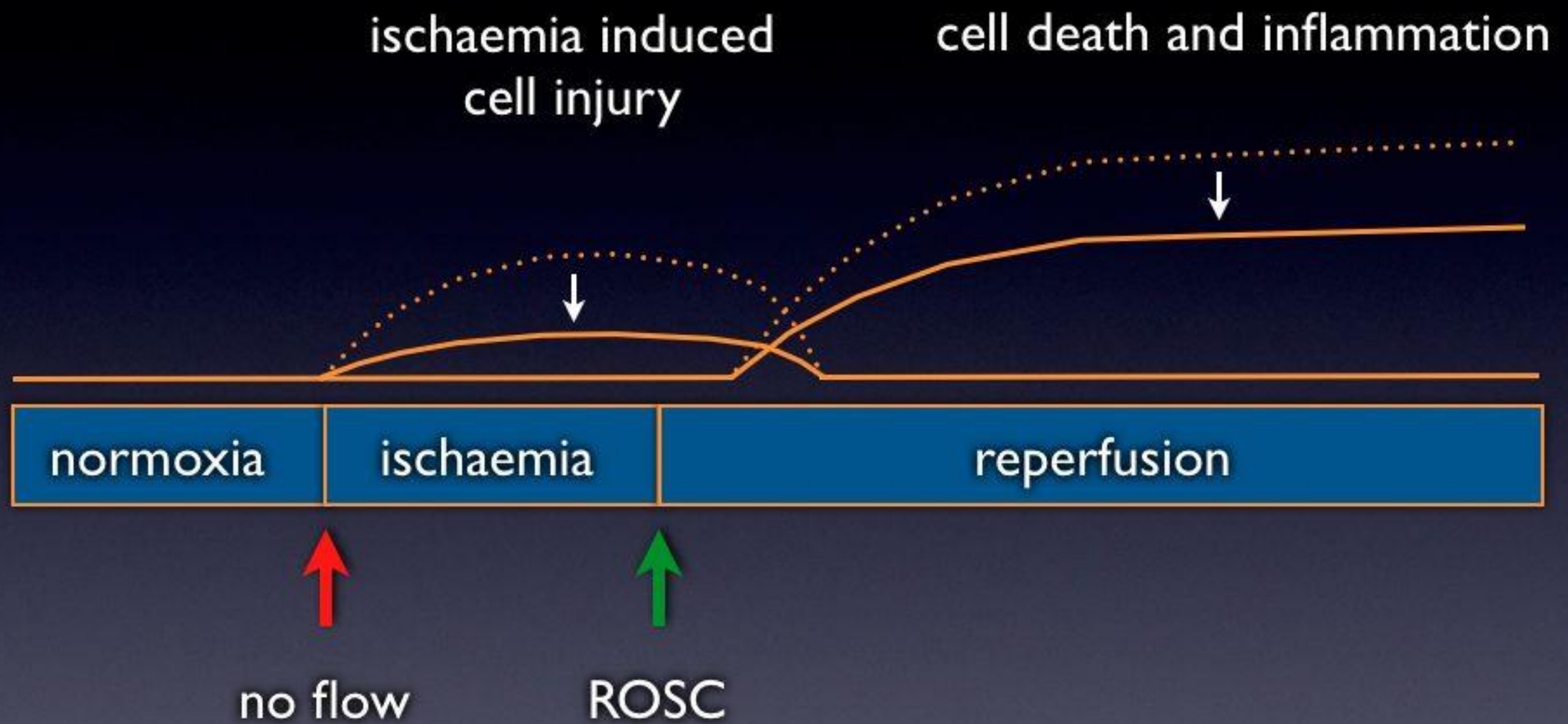


ischaemia induced
cell injury









really?

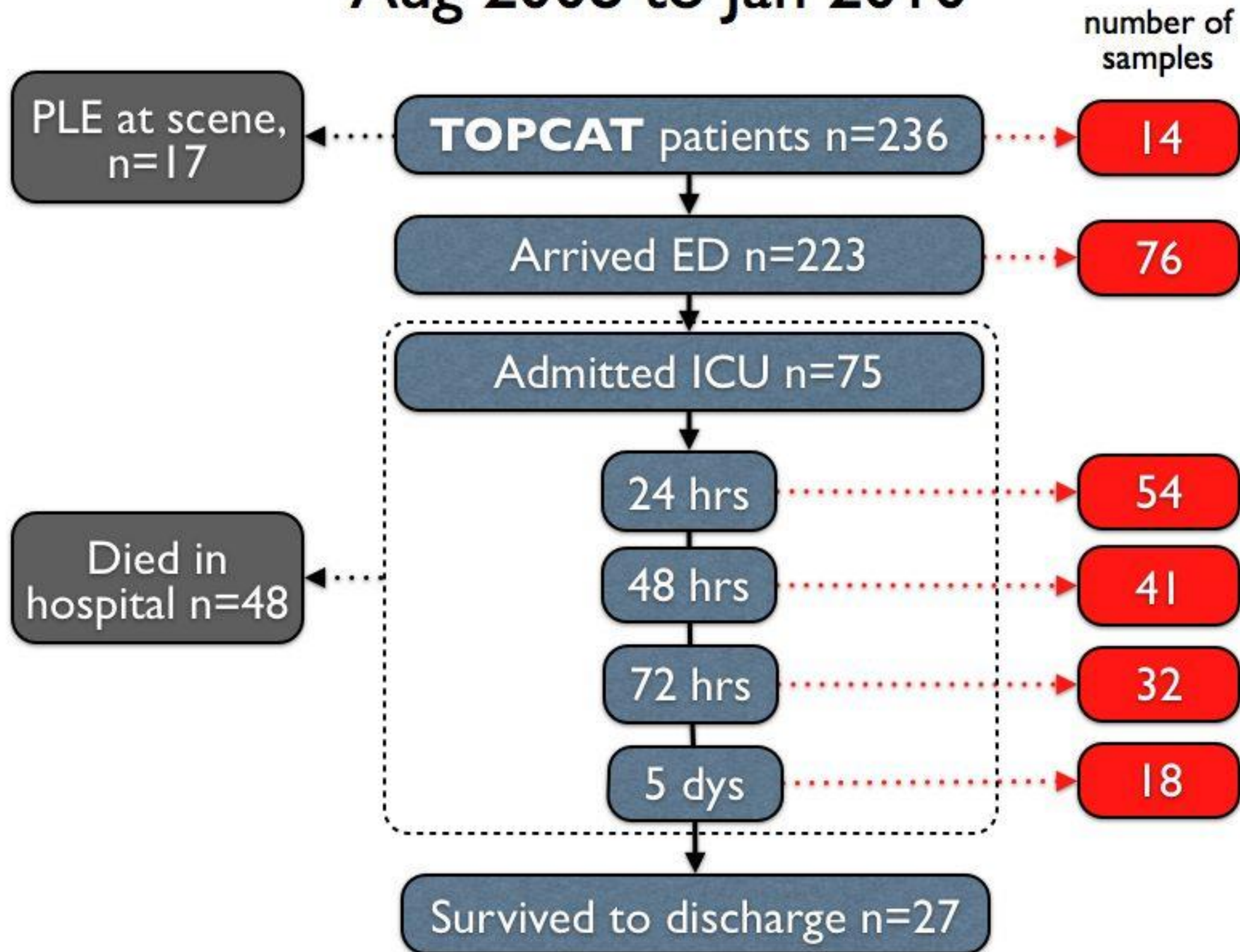


TOPCAT



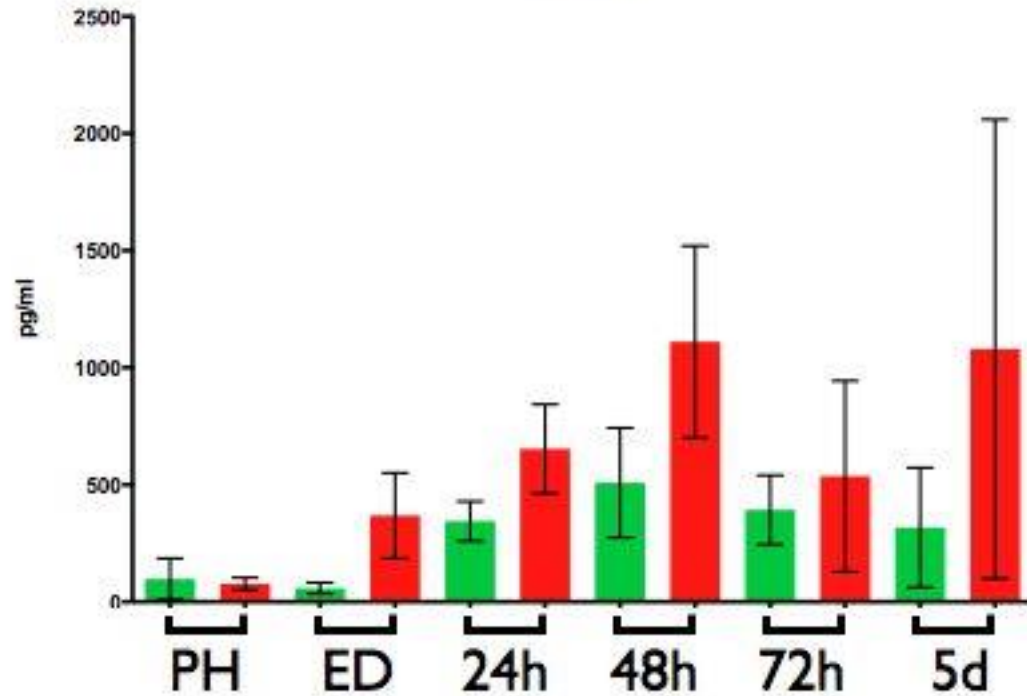
Recruitment of patients to TOPCAT

Aug 2008 to Jan 2010

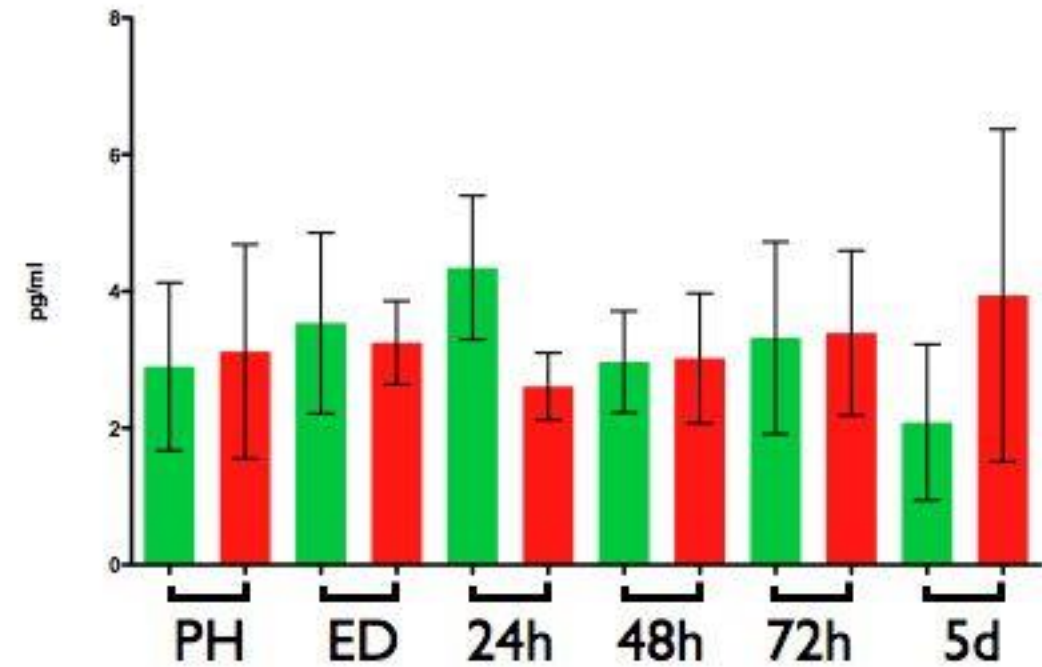


Pattern of IL-6, TNFa, IL-8 and IL-10 post ROSC survivors vs non-survivors

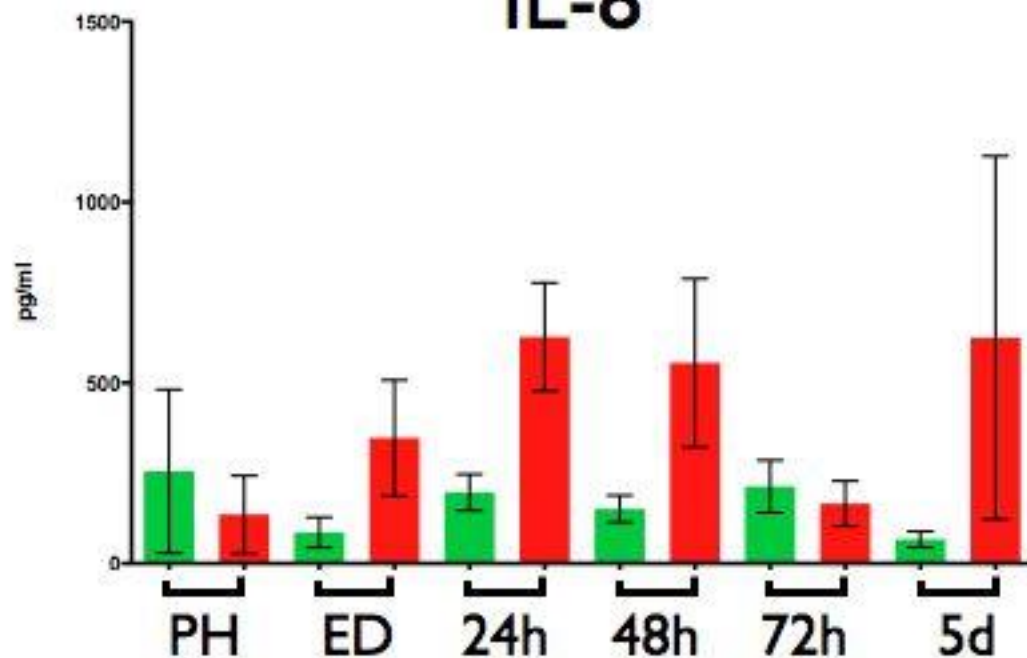
IL-6



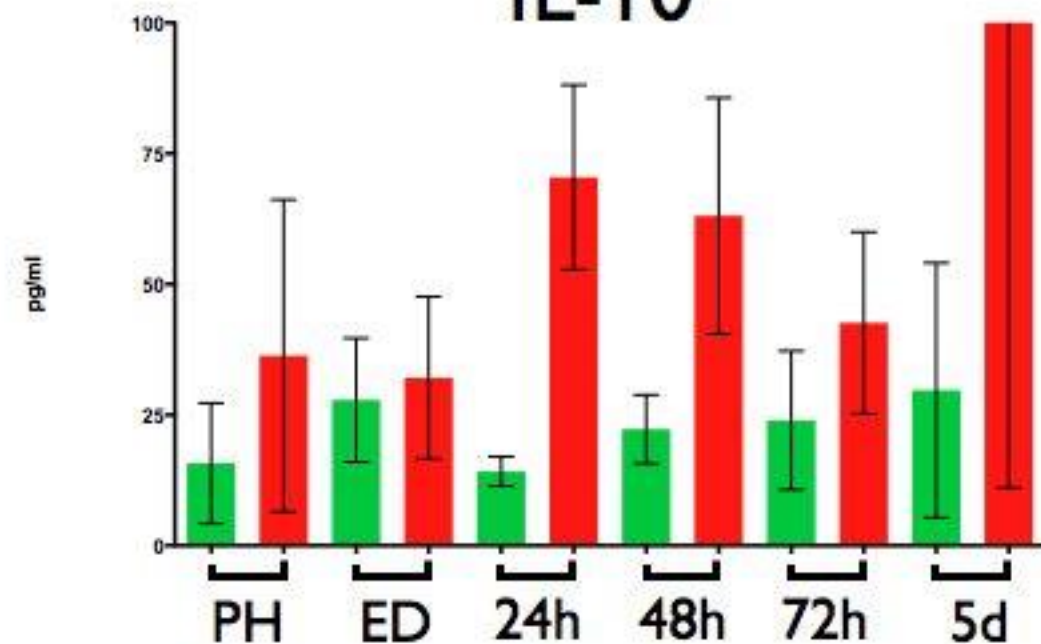
TNFa



IL-8

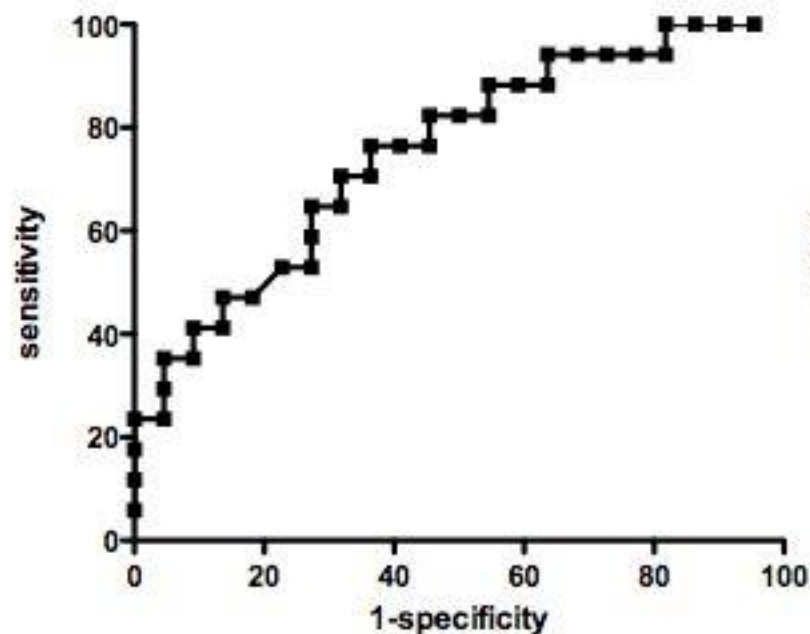


IL-10



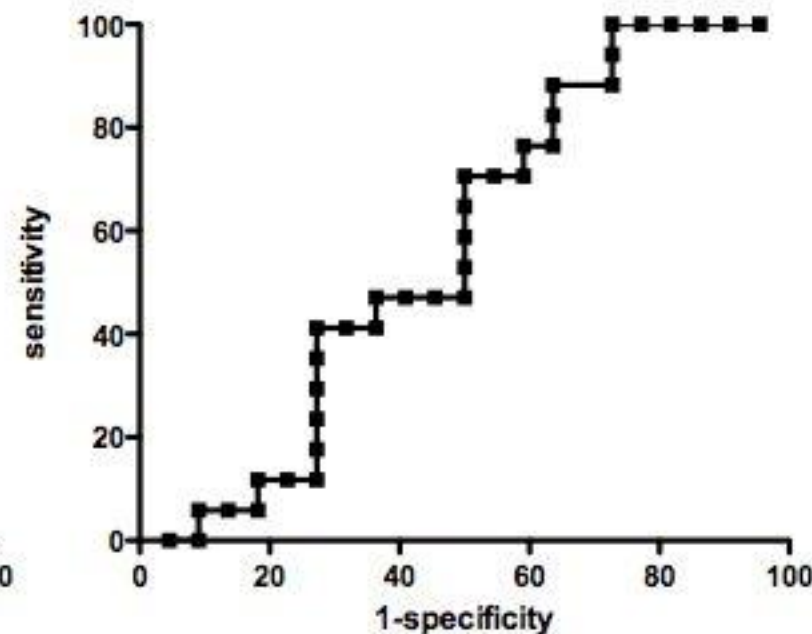
ROC curves for ability of IL-8, IL-6 and IL-10 at 24 hours to predict survival post ROSC

IL-8



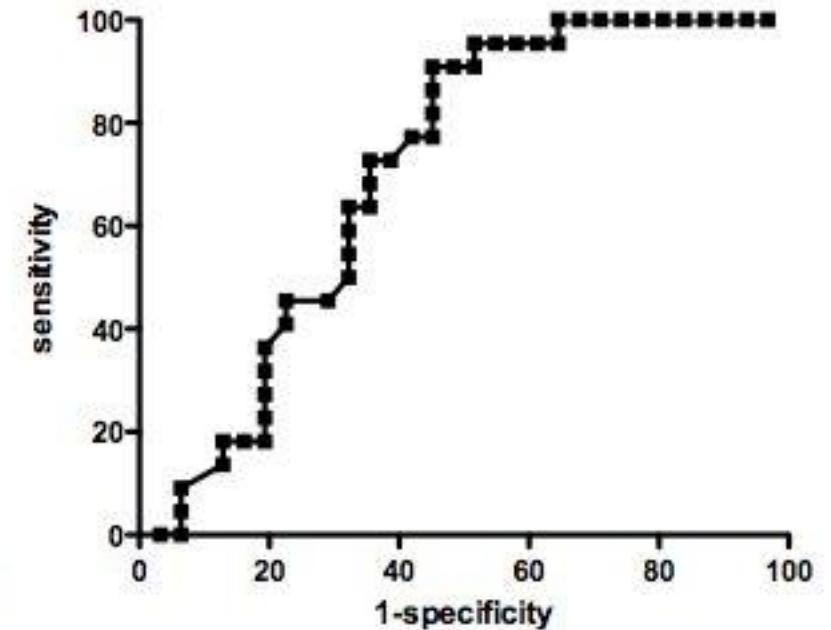
AUC: **0.75**

IL-6



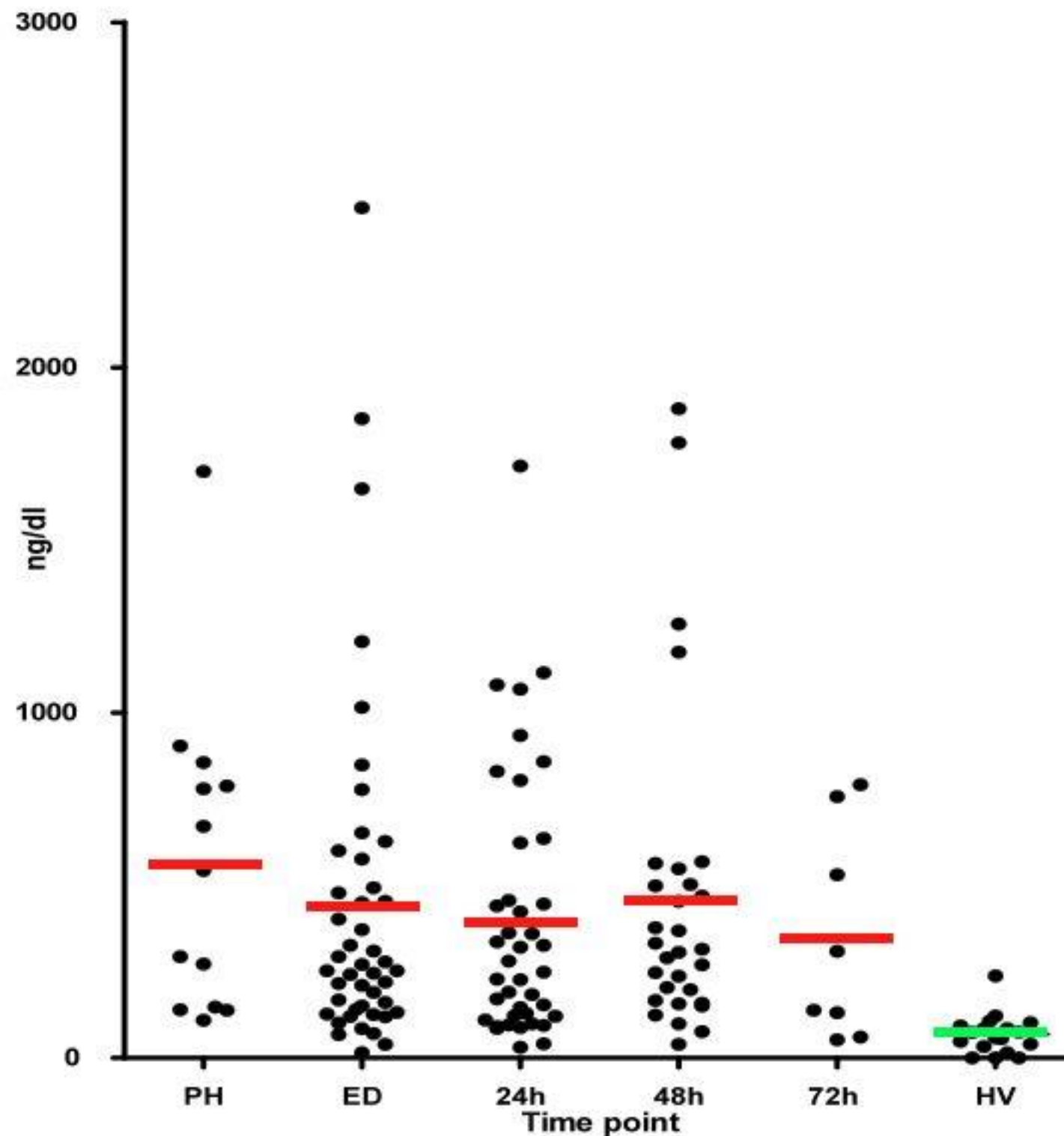
0.57

IL-10



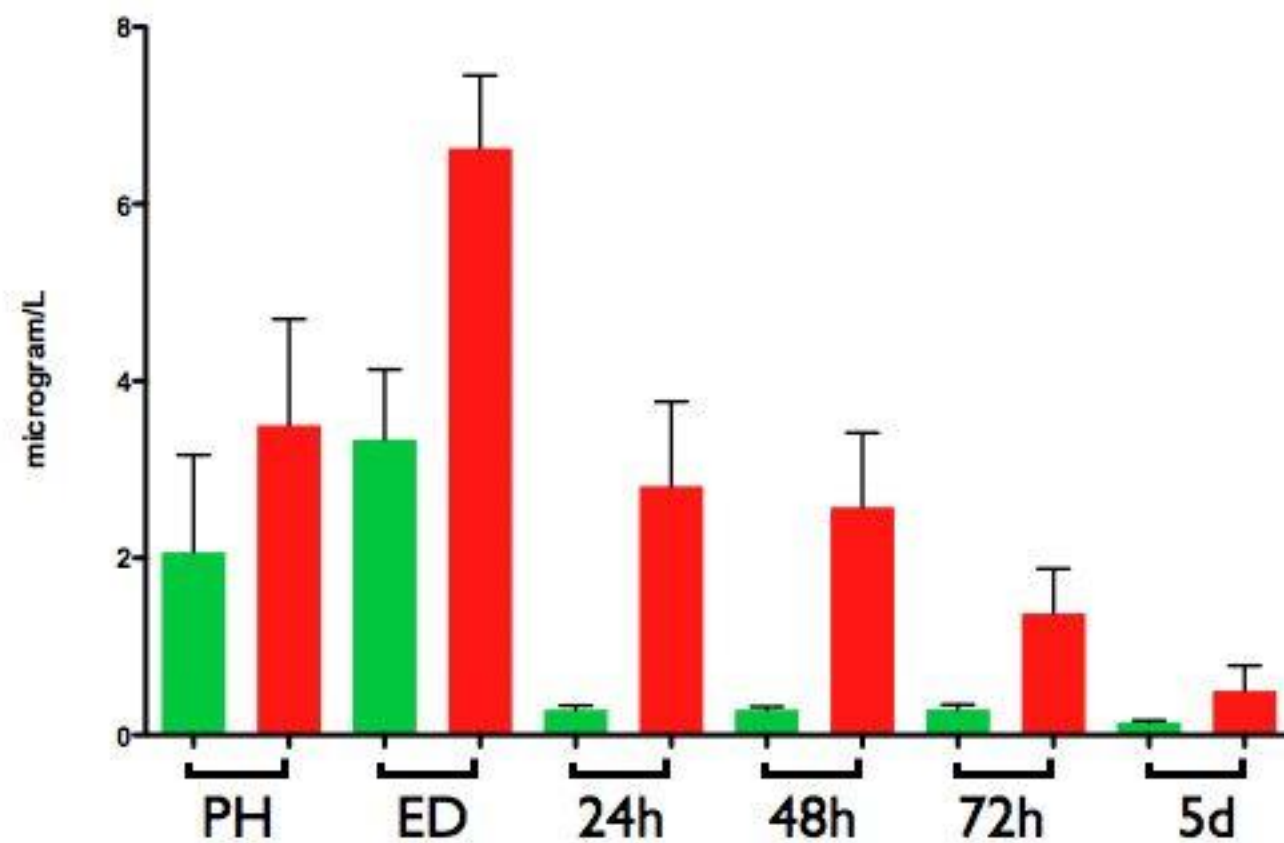
0.71

Human Neutrophil Elastase - all patients presenting with VF who had ROSC

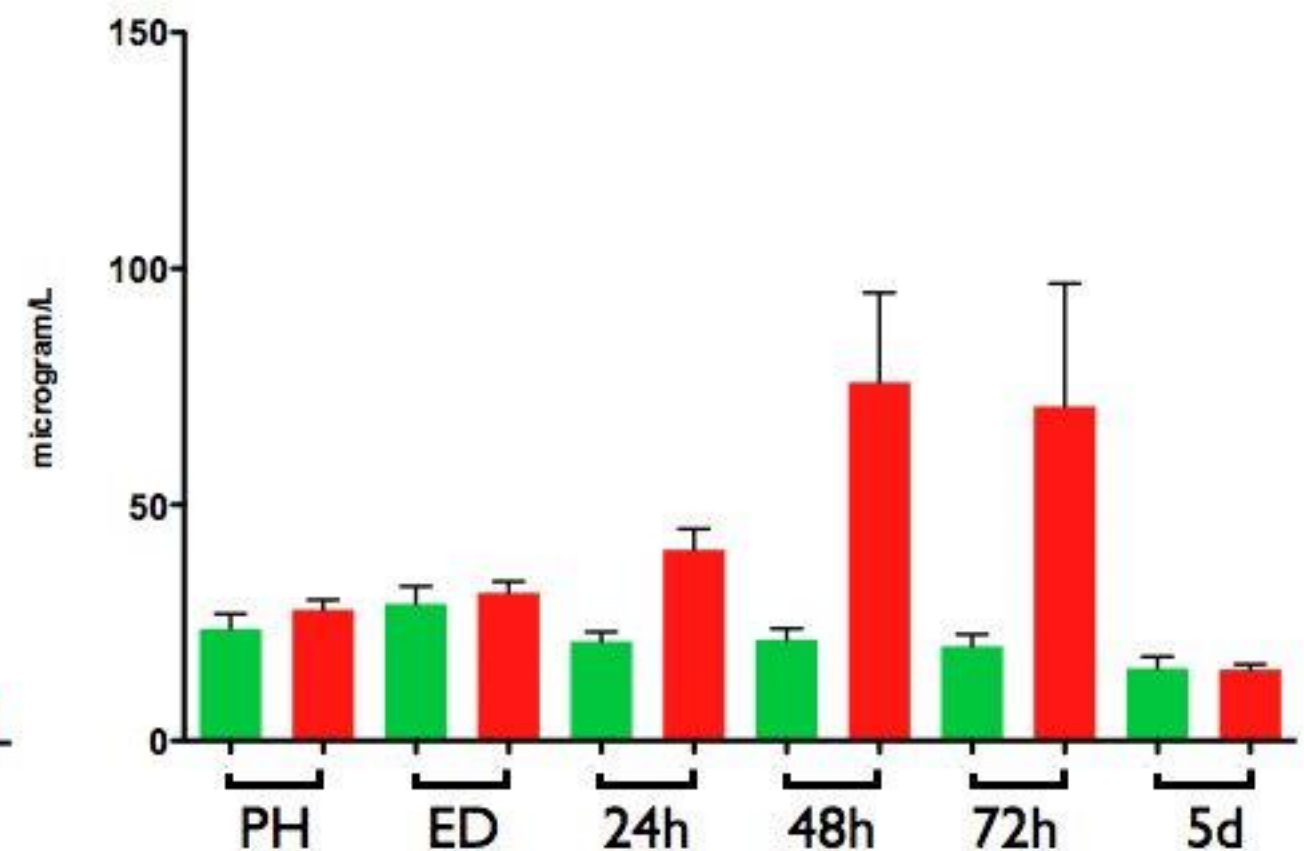


Serum markers of brain injury S100b and NSE post ROSC

S100b



NSE



NPL activation ED and persists

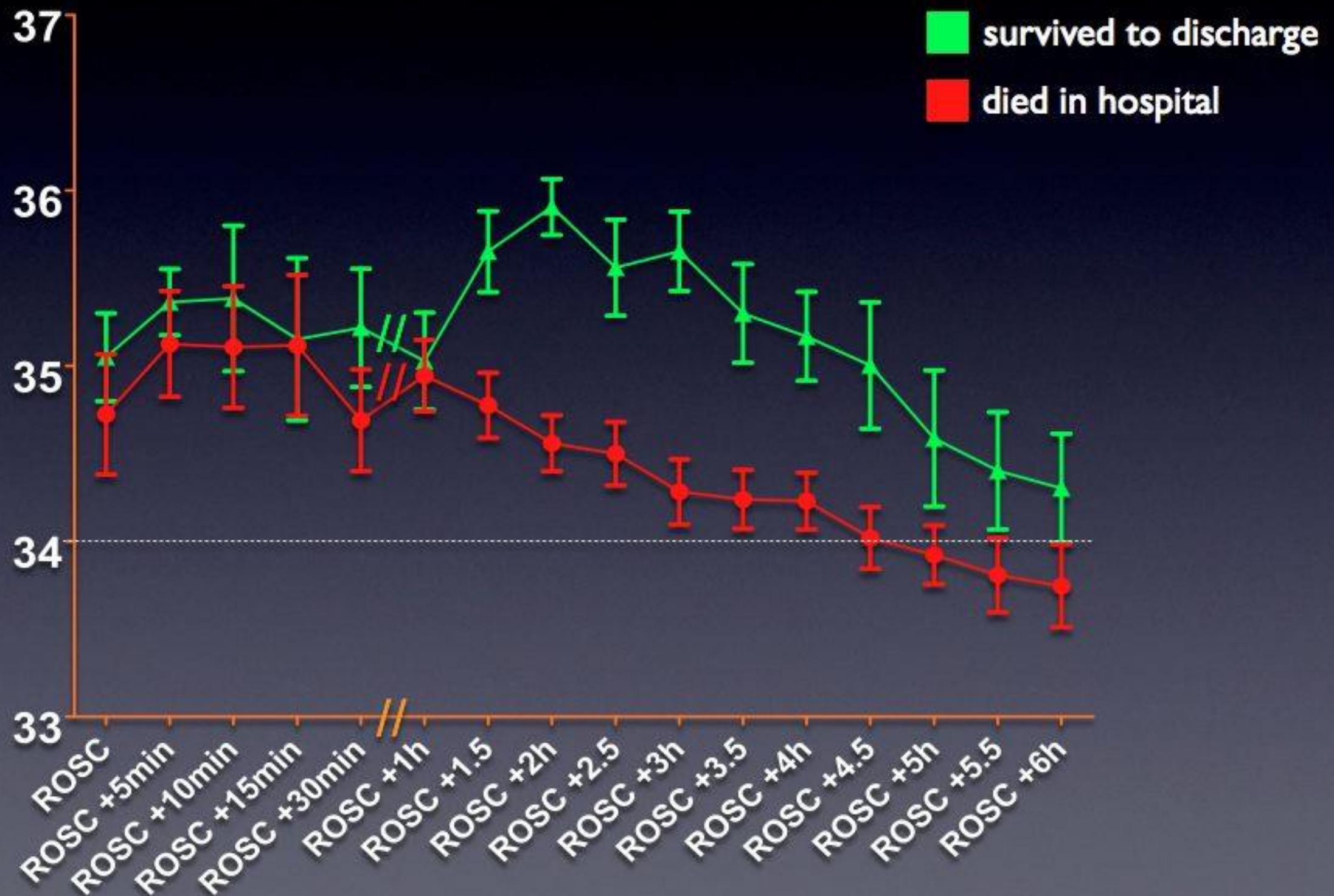
systemic cytokines 24-48 hr

brain injury ED-72 hrs

Temperature profile over first 3 hours after OHCA



Oesophageal temperatures of survivors (n=19) vs non-survivors (n=40)

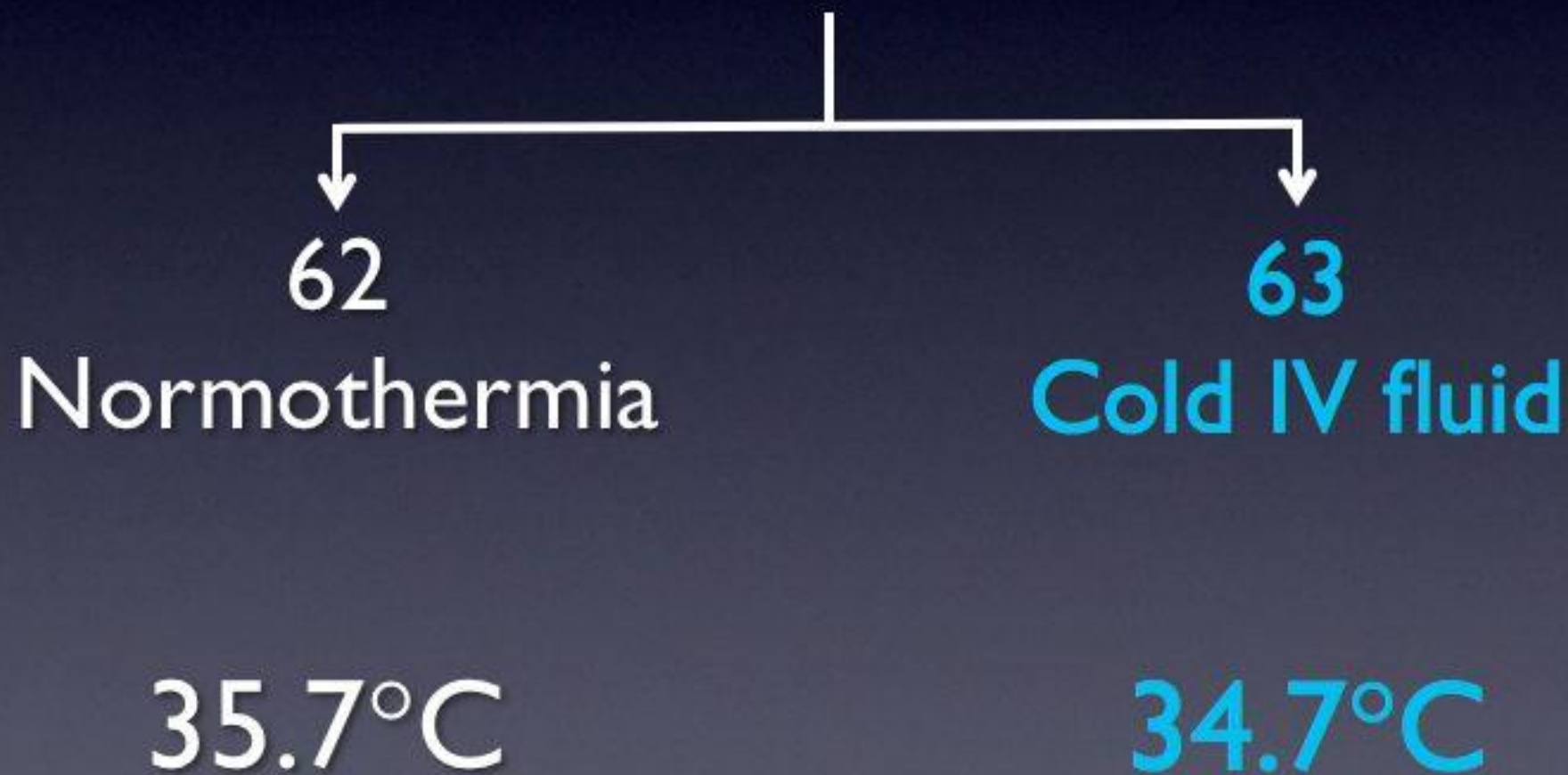


when
should we
cool?

Pre-hospital cooling

Kim F et al. Circulation 2007; 115:3064-3070

125 post ROSC OHCA



Pre-hospital cooling

Kim F et al. Circulation 2007; 115:3064-3070

125 post ROSC OHCA



35.7°C

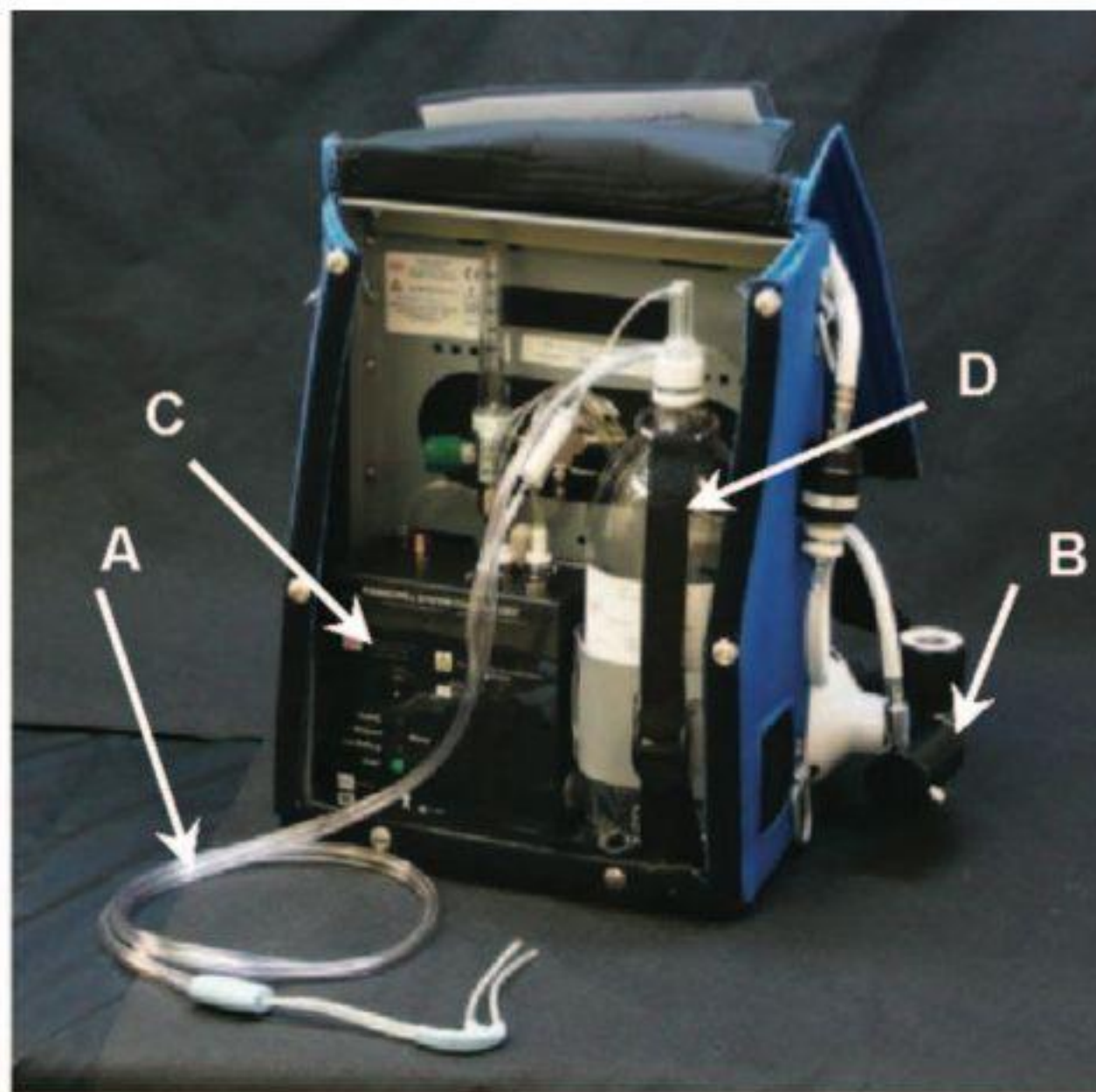
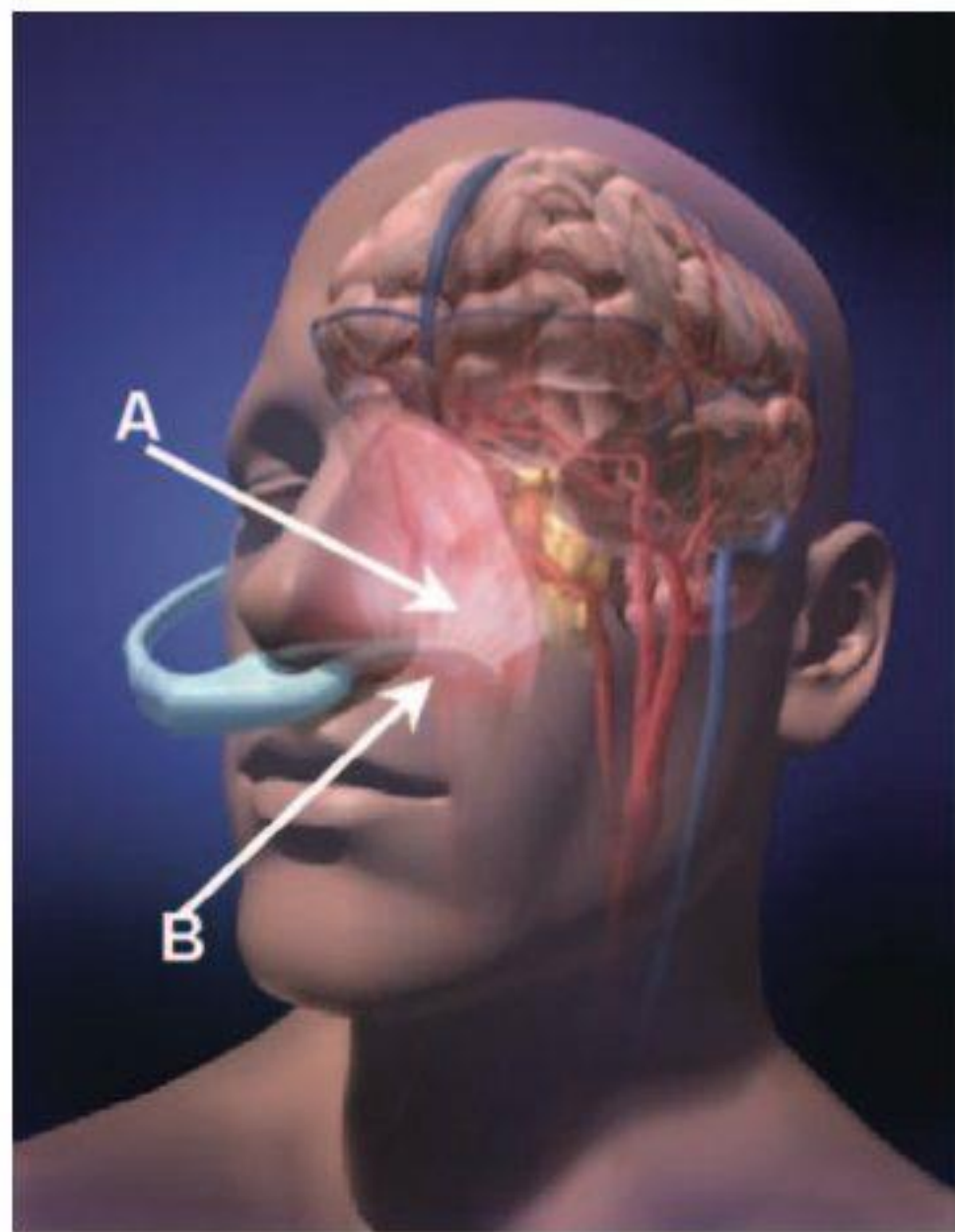
34.7°C

34.7°C



prince and princess?

Intra-Arrest Transnasal Evaporative Cooling. A Randomized, Prehospital, Multicenter Study (PRINCE: Pre-ROSC IntraNasal Cooling Effectiveness)



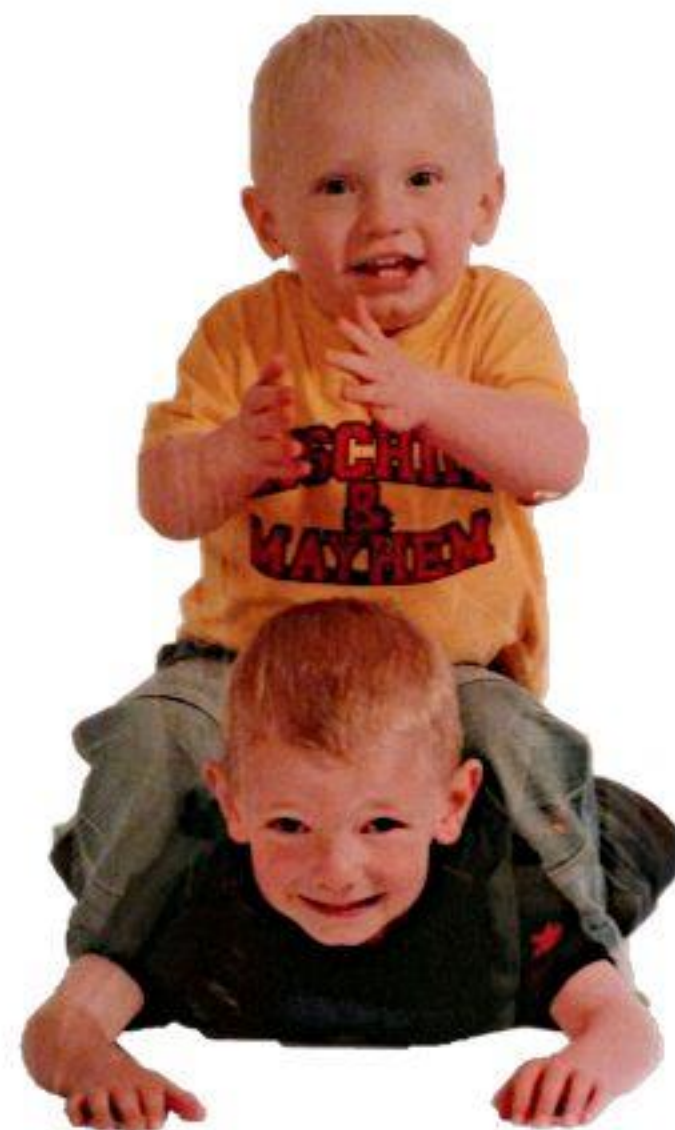
how do
we cool?

Methods for inducing MTH in the ED

Invasive	Non-invasive
Cold iv fluid infusion	Ice-packs
Extracorporeal circuit	Cooling blankets
Lavage - ng, pr, peritoneal	Cooling helmet
Endovascular cooling	Cold water immersion
	Cooling pads
	nasopharyngeal

so what?





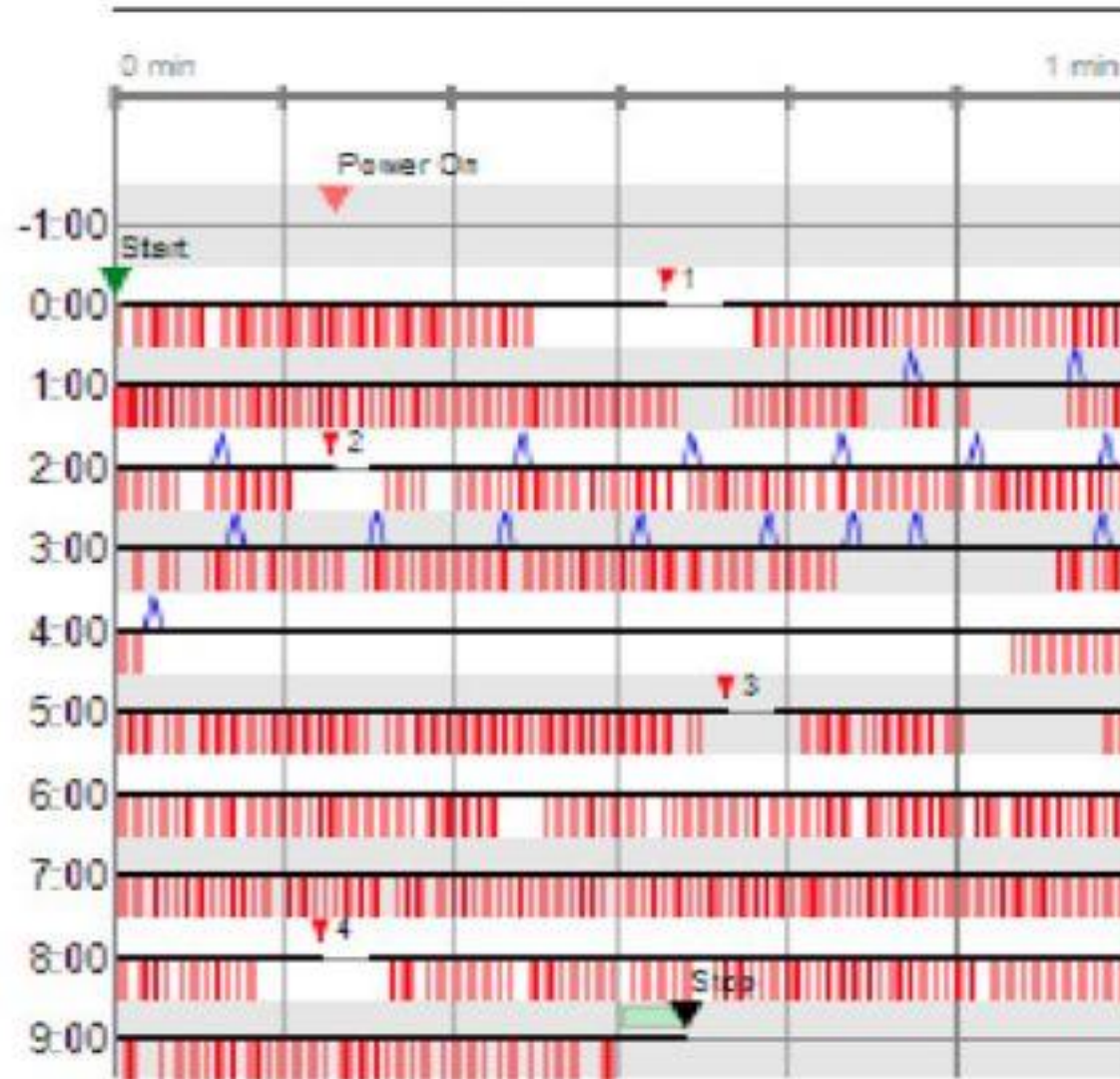




A B C

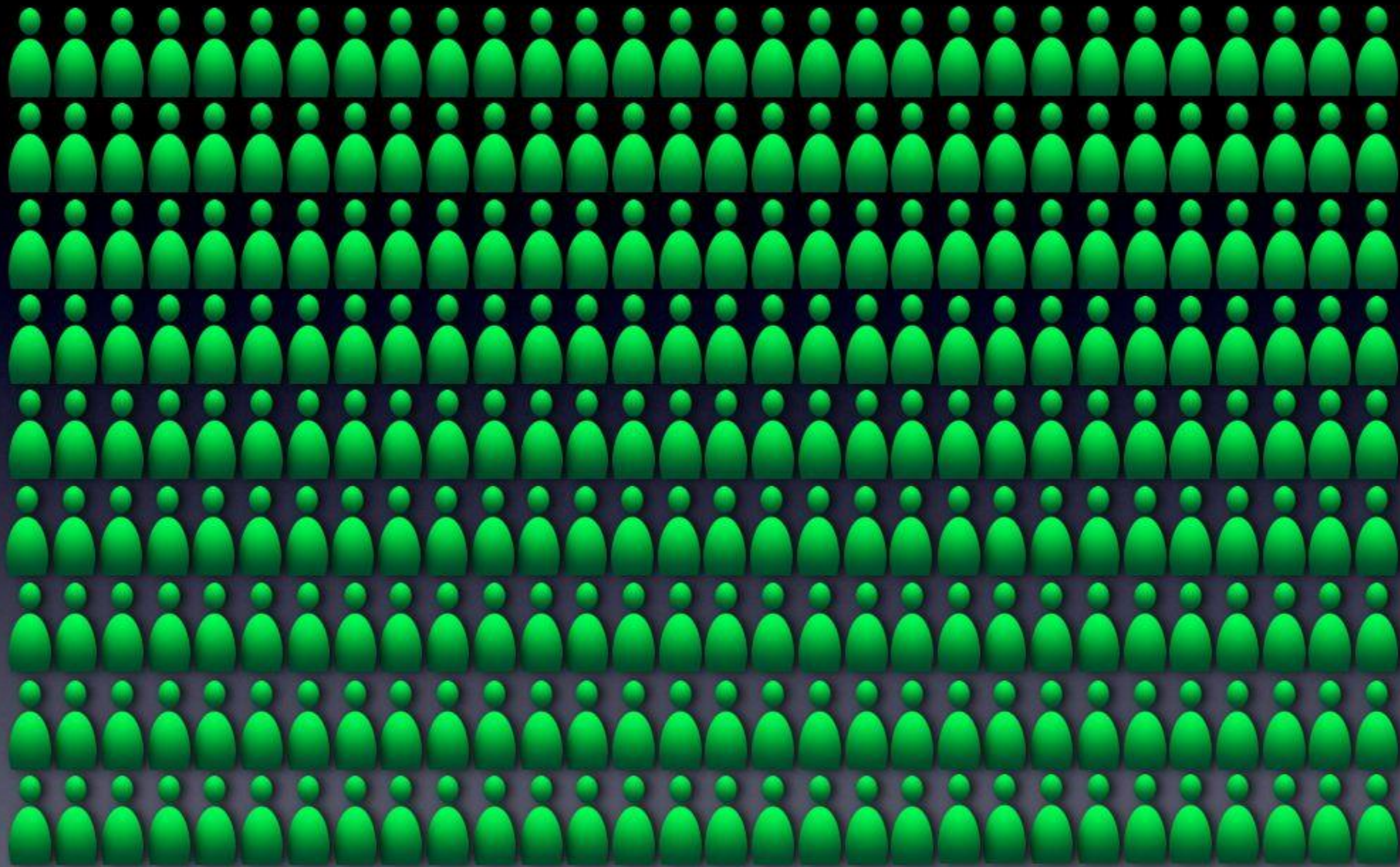
CPR QUIK-VIEW

Interval Statistics



CPR Ratio, %	Prompt CPR Ratio, %	Compr. Ratio, %	Prompt Compr. Ratio, %	Compr. Rate	Compr. /min	Vent. Rate	Vent. /min
--	--	--	--	--	--	--	--
84	--	84	--	141	110	--	--
100	--	87	--	127	104	2	2
100	--	95	--	125	106	6	6
79	--	79	--	127	88	7	8
16	--	16	--	126	19	--	1
100	--	83	--	127	96	--	--
100	--	97	--	126	115	--	--
100	--	100	--	117	115	--	--
100	--	92	--	121	104	--	--
100	--	100	--	120	106	--	--

Shock	Time	Energy	Pre-shock CPR Pause	Post-shock CPR Pause
1	0:33	200J	0:08	0:05
2	2:13	300J	0:02	0:03
3	5:36	360J	0:02	0:04
4	8:12	360J	0:04	0:04





Viva la Revolution!

Acknowledgements

Richard Lyon

Sarah Richardson

Scott Clarke

Andrew Conway-Morris

Peter Andrews

Scottish Ambulance Service

Paul Gowens

Gerry Egan

Physio Control

Sandpiper Trust

Chest, Heart and Stroke Scotland





EDINBURGH