Printemps des urgences 2022

11ème édition - mardi 10 mai

Hypothermie, Calcium, Bicarbonates…

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Déclaration de liens

Déclare les liens suivants :

- Pas de liens d'intérêt en rapport avec la présentation

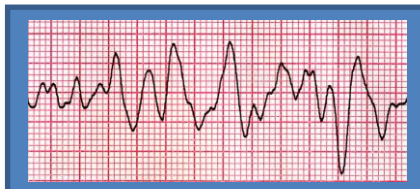
- Support de recherche

Zoll Medical, Nonin, Advanced CPR solution, Stryker

Stop doing
what doesn't
work!

Place de l’hypothermie, du Calcium, des bicar et des corticoïdes

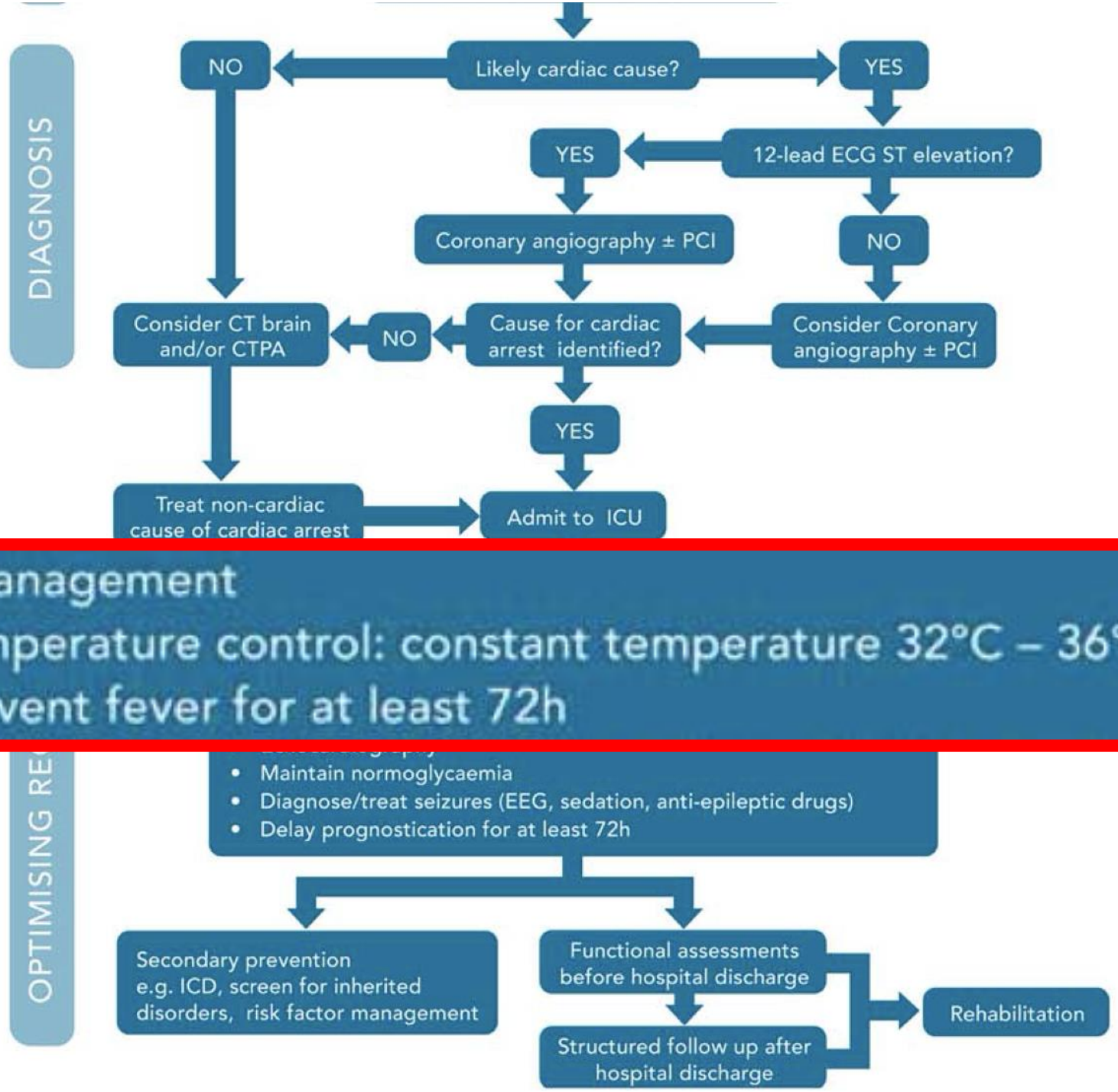
Hypothermie
Calcium
Bicarbonates
Corticoïdes



Arrêt cardiaque
No Flow

RCP
Low Flow

RACS
Post AC syndrôme

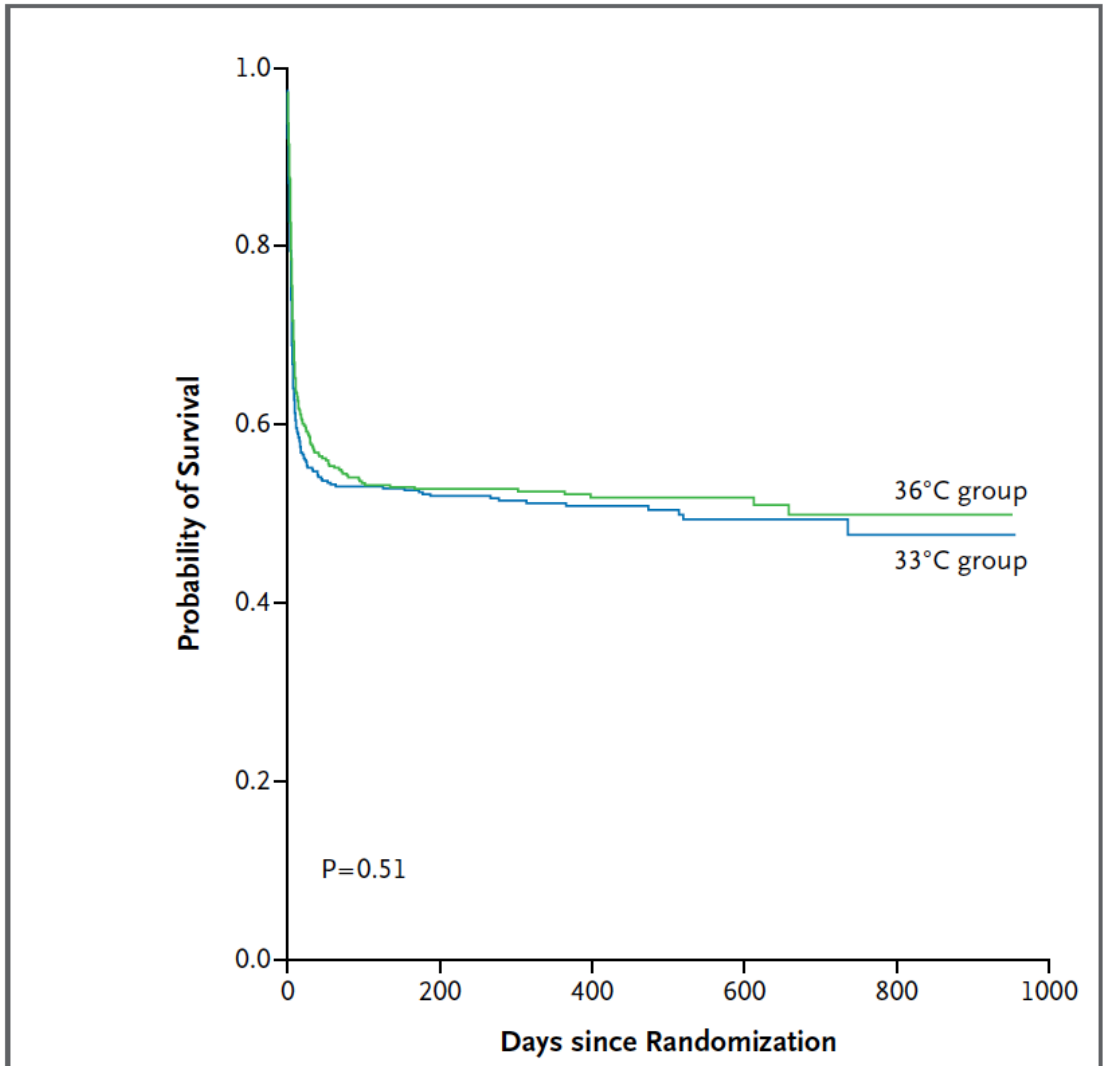

DIAGNOSIS
Likely cardiac cause?
NO
YES
12-lead ECG ST elevation?
YES
NO
Coronary angiography ± PCI
Consider CT brain and/or CTPA
NO
Cause for cardiac arrest identified?
Consider Coronary angiography ± PCI
YES
Treat non-cardiac cause of cardiac arrest
Admit to ICU
ICU management
• Temperature control: constant temperature 32°C – 36°C for ≥ 24h; prevent fever for at least 72h
OPTIMISING RE
• Maintain normoglycaemia
• Diagnose/treat seizures (EEG, sedation, anti-epileptic drugs)
• Delay prognostication for at least 72h
Secondary prevention e.g. ICD, screen for inherited disorders, risk factor management
Functional assessments before hospital discharge
Structured follow up after hospital discharge
Rehabilitation

Targeted Temperature Management at 33°C versus 36°C after Cardiac Arrest

Niklas Nielsen, M.D., Ph.D., Jørn Wetterslev, M.D., Ph.D., Tobias Cronberg, M.D., Ph.D., David Erlinge, M.D., Ph.D., Yvan Gasche, M.D., Christian Hassager, M.D., D.M.Sci., Janneke Horn, M.D., Ph.D., Jan Hovdenes, M.D., Ph.D., Jesper Kjaergaard, M.D., D.M.Sci., Michael Kuiper, M.D., Ph.D., Tommaso Pellis, M.D., Pascal Stammet, M.D., et al., for the TTM Trial Investigators*

The NEW ENGLAND JOURNAL of MEDICINE

Étude randomisée contrôlée
939 patients



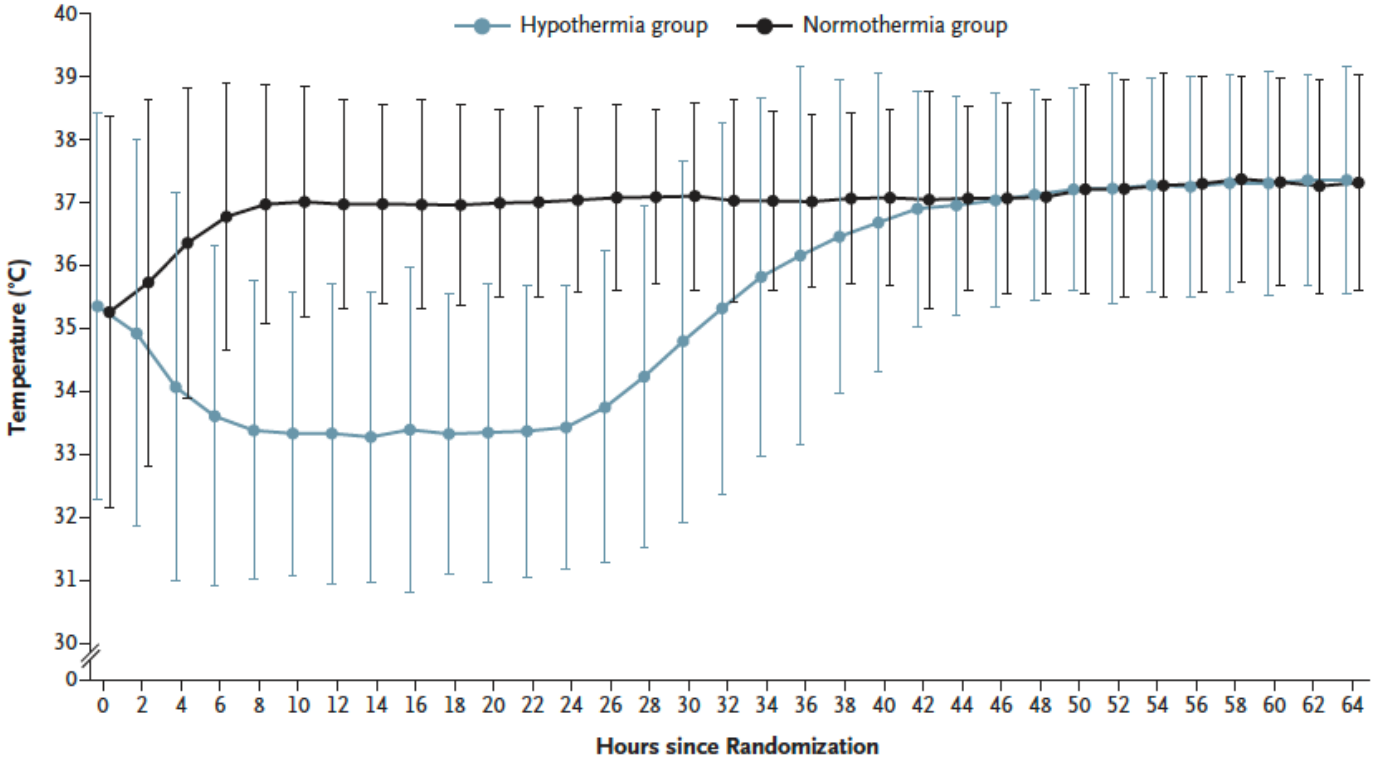
ORIGINAL ARTICLE

Targeted Temperature Management for Cardiac Arrest with Nonshockable Rhythm

J.-B. Lascarrou, H. Merdji, A. Le Gouge, G. Colin, G. Grillet, P. Girardie, E. Coupez, P.-F. Dequin, A. Cariou, T. Boulain, N. Brule, J.-P. Frat, P. Asfar, N. Pichon, M. Landais, G. Plantefeve, J.-P. Quenot, J.-C. Chakarian, M. Sirodot, S. Legriel, J. Letheulle, D. Thevenin, A. Desachy, A. Delahaye, V. Botoc, S. Vimeux, F. Martino, B. Giraudeau, and J. Reignier, for the CRICS-TRIGGERSEP Group*

N Engl J Med. 2019 Oct 2

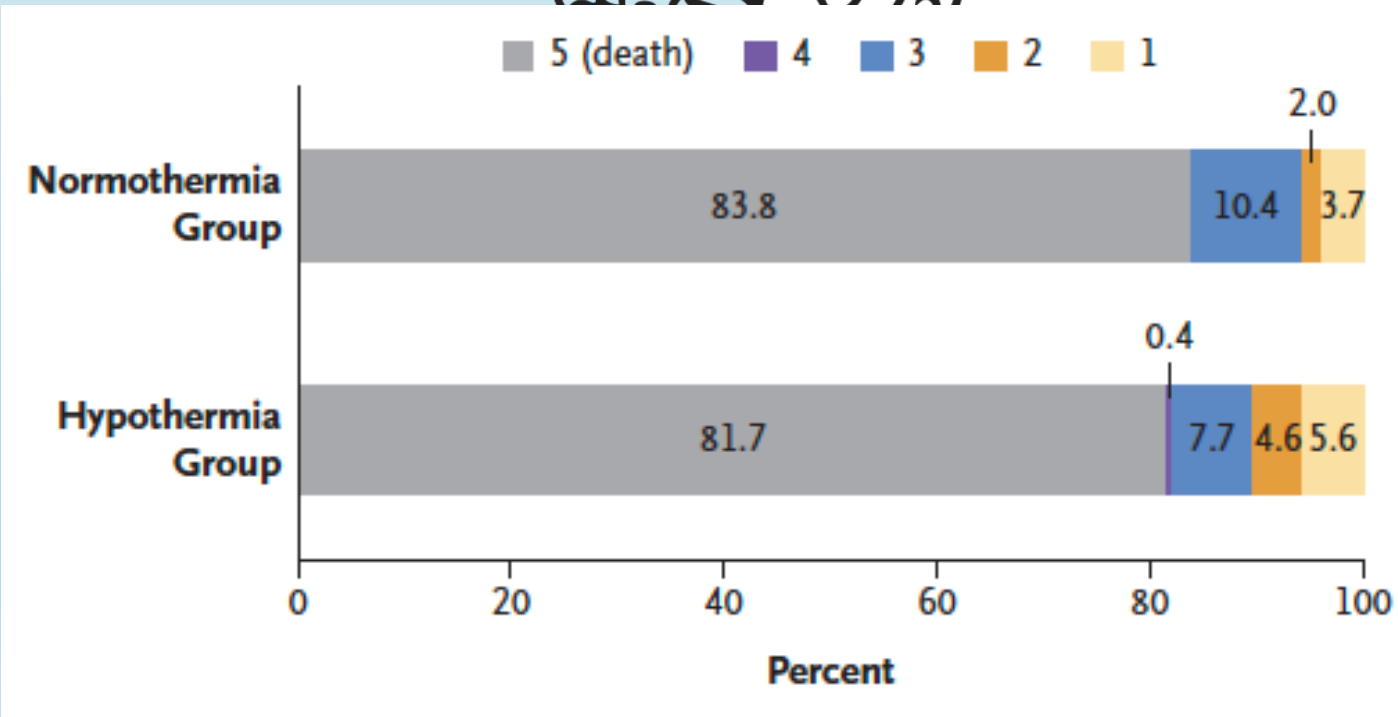
Étude randomisée contrôlée
584 patients
Rythme non choquable



Bon devenir neurologique à 90J

Hypothermie

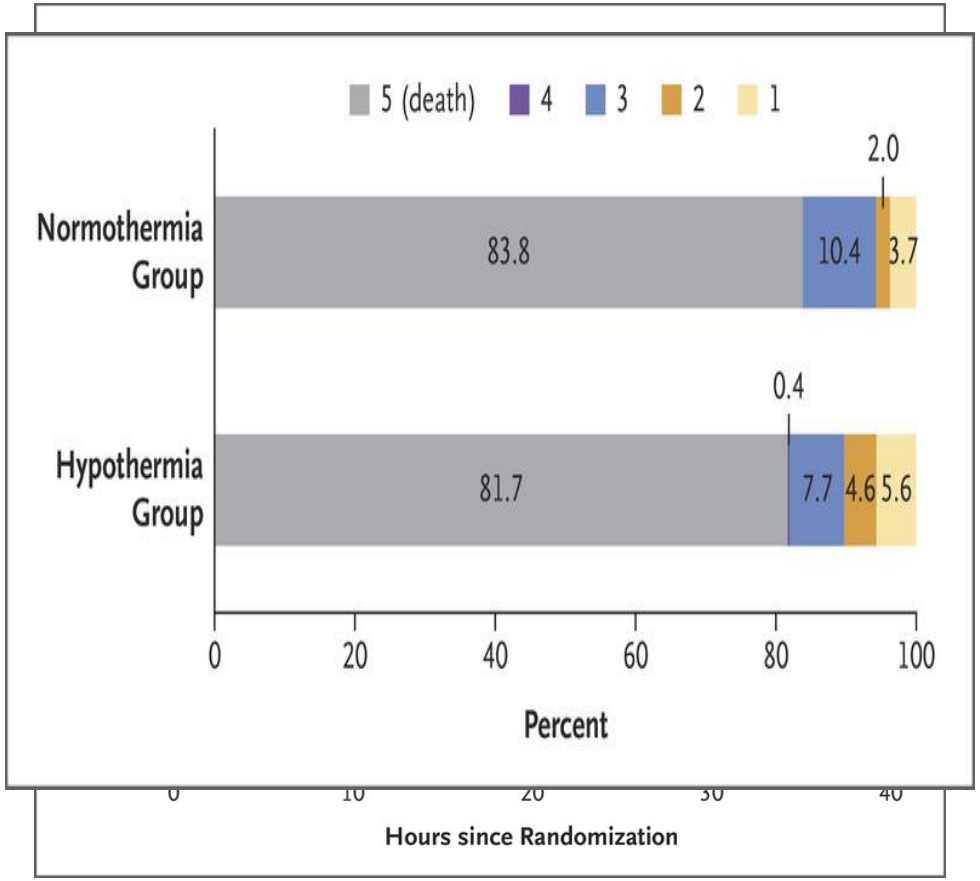
Normothermie

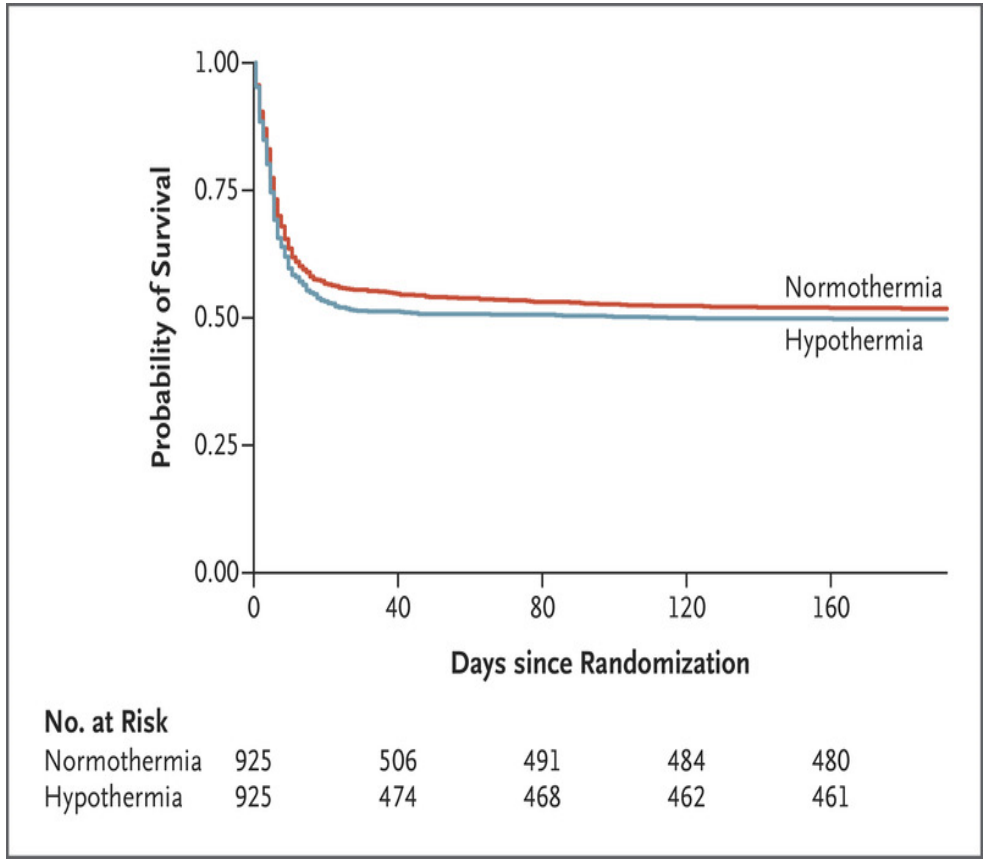


Hypothermia versus Normothermia after Out-of-Hospital Cardiac Arrest

Josef Dankiewicz, M.D., Ph.D., Tobias Cronberg, M.D., Ph.D., Gisela Lilja, O.T., Ph.D., Janus C. Jakobsen, M.D., Ph.D., Helena Levin, M.Sc., Susann Ullén, Ph.D., Christian Rylander, M.D., Ph.D., Matt P. Wise, M.B., B.Ch., D.Phil., Mauro Oddo, M.D., Alain Cariou, M.D., Ph.D., Jan Bělohlávek, M.D., Ph.D., Jan Hovdenes, M.D., Ph.D., et al., for the TTM2 Trial Investigators*

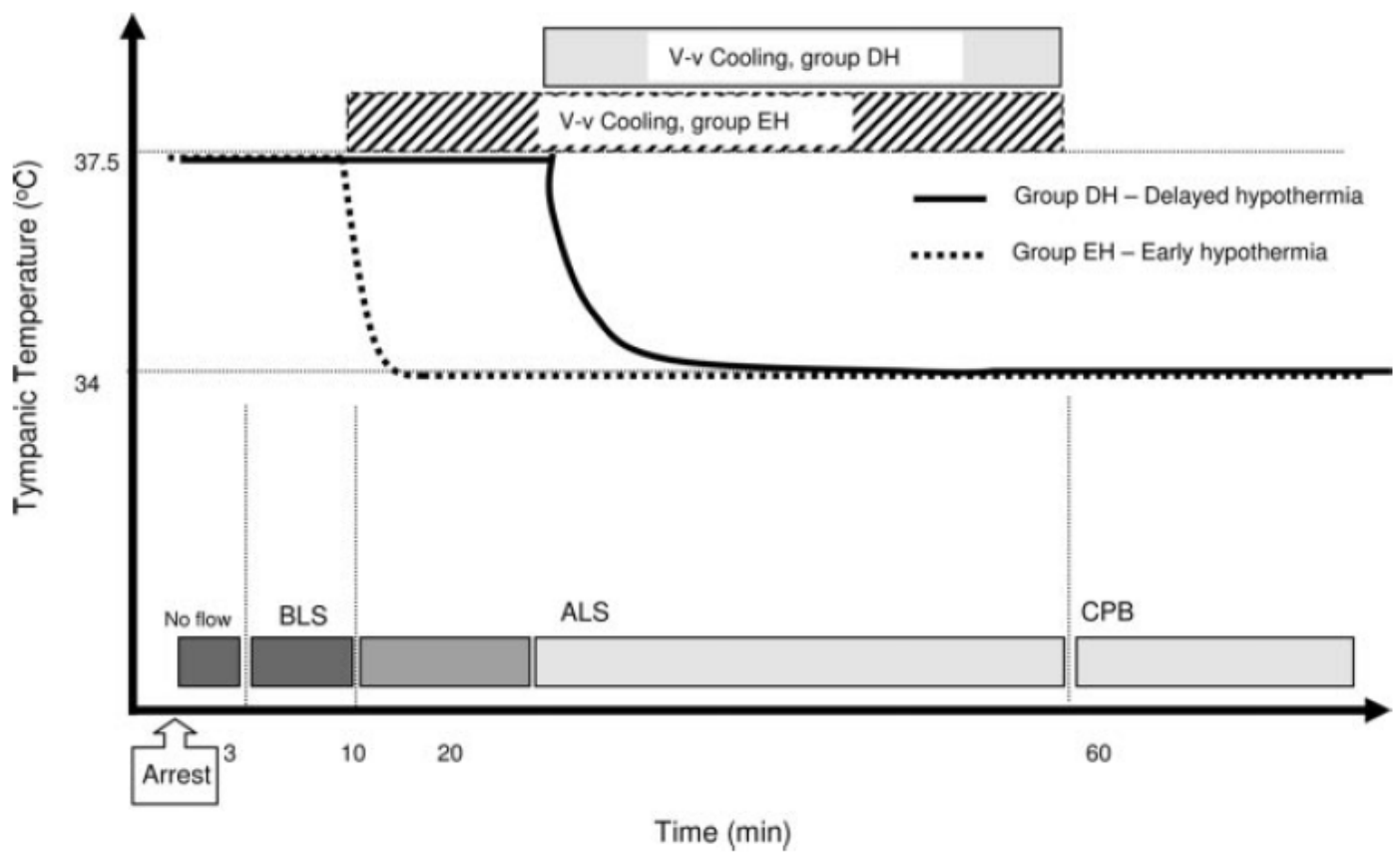
The NEW ENGLAND JOURNAL of MEDICINE





Intérêt de l'hypothermie précoce ?

Nombreuses études montrant un bénéfice chez l'animal



TIME TO COOLING

Time to intra-arrest hypothermia and its association with neurologic outcome

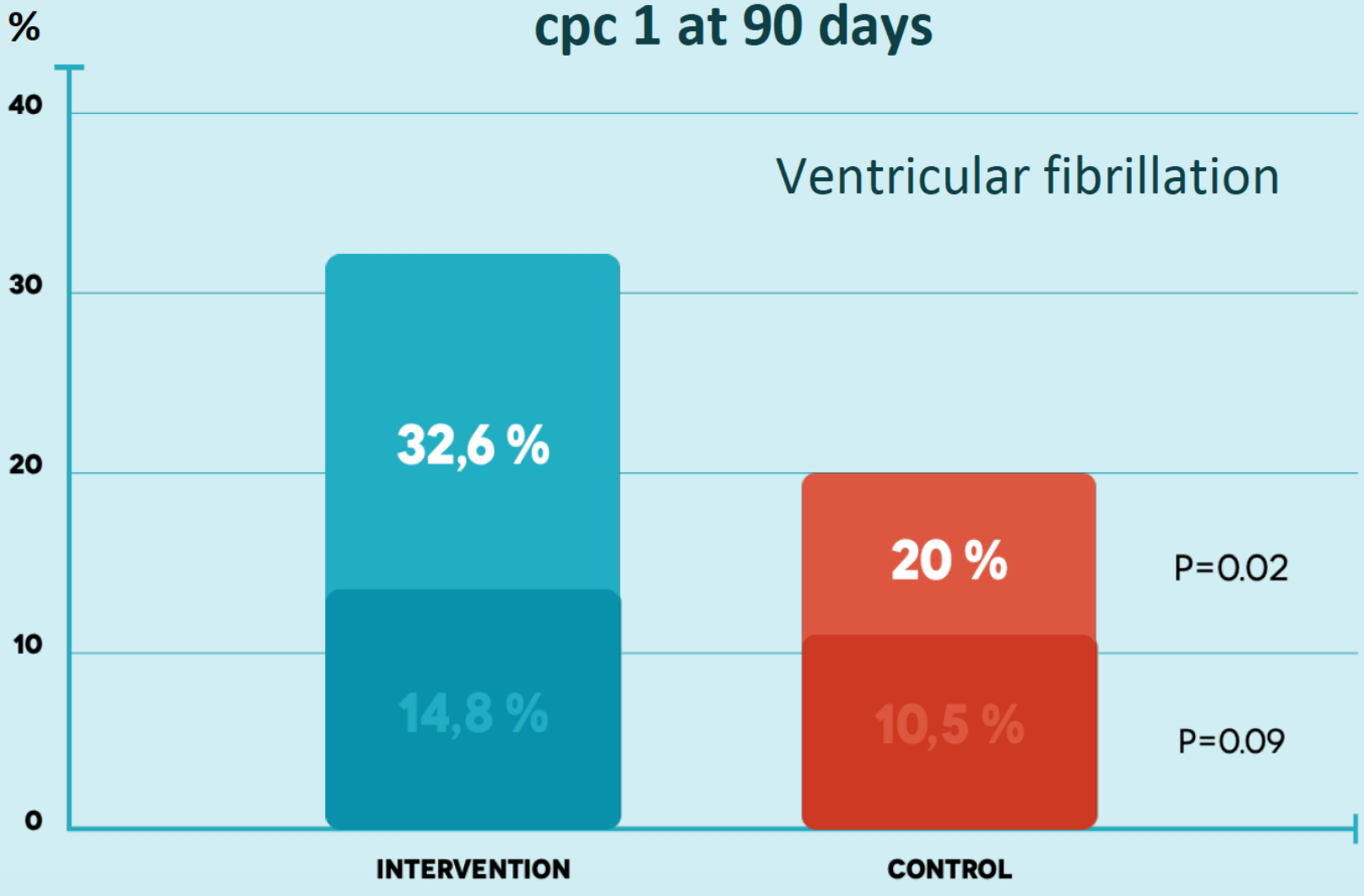
PRINCESS TRIAL

1. SUMMARY PRINCESS
2. TIME ASSOCIATION
3. POOLED ANALYSIS

Per Nordberg, MD, PhD,
Center for Resuscitation Science,
Karolinska Institutet, Stockholm, Sweden

DISCLOSURES:
Laerdal Foundation
Swedish Heart and Lung Foundation
BrainCool AB – provided
cooling devices without cost

Complete recovery



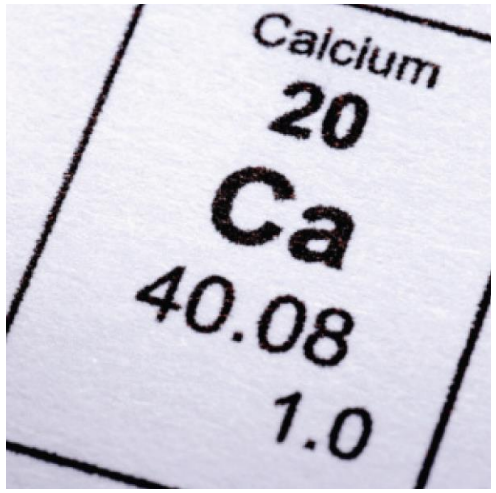
ICM RAPID PRACTICE GUIDELINE

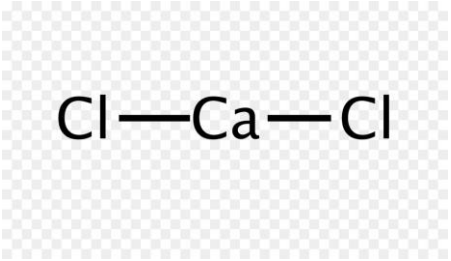
ERC-ESICM guidelines on temperature control after cardiac arrest in adults

Claudio Sandroni[1,2*], Jerry P. Nolan[3,4], Lars W. Andersen[5,6,7], Bernd W. Böttiger[8], Alain Cariou[9], Tobias Cronberg[10], Hans Friberg[11], Cornelia Genbrugge[12,13], Gisela Lilja[10], Peter T. Morley[14], Nikolaos Nikolaou[15], Theresa M. Olasveengen[16], Markus B. Skrifvars[17], Fabio S. Taccone[18] and Jasmeet Soar[19]

GOOD PRACTICE	We **recommend** continuous monitoring of core temperature in patients who remain comatose after ROSC from cardiac arrest.
LOW	We **recommend** actively preventing fever (defined as a temperature > 37.7°C) in post-cardiac arrest patients who remain comatose.
GOOD PRACTICE	We **recommend** actively preventing fever for at least 72 hours in post-cardiac arrest patients who remain comatose.
GOOD PRACTICE	Temperature control can be achieved by exposing the patient, using anti-pyretic drugs, or if this is insufficient, by using a cooling device with a target temperature of 37.5°C.
GOOD PRACTICE	There is currently insufficient evidence to recommend for or against temperature control at 32-36°C in sub-populations of cardiac arrest patients or using early cooling, and future research may help elucidate this. We **recommend not** actively rewarming comatose patients with mild hypothermia after ROSC to achieve normothermia.
MODERATE	We **recommend not** using prehospital cooling with rapid infusion of large volumes of cold IV fluid immediately after ROSC.

1/ Monitorer la température
2/ Prévenir activement la fièvre
3/ Pas suffisamment de preuve pour recommender en faveur ou contre le CCT entre 32-36°C





British Journal of Anaesthesia 1991; 67: 178–184

CALCIUM FOR RESUSCITATION?

E. ERDMANN AND E. REUSCHEL-JANETSCHEK

Effet inotrope +
Vasopresseur
Effet antagoniste de l'effet pro-arrythmique de l'hyperkaliémie

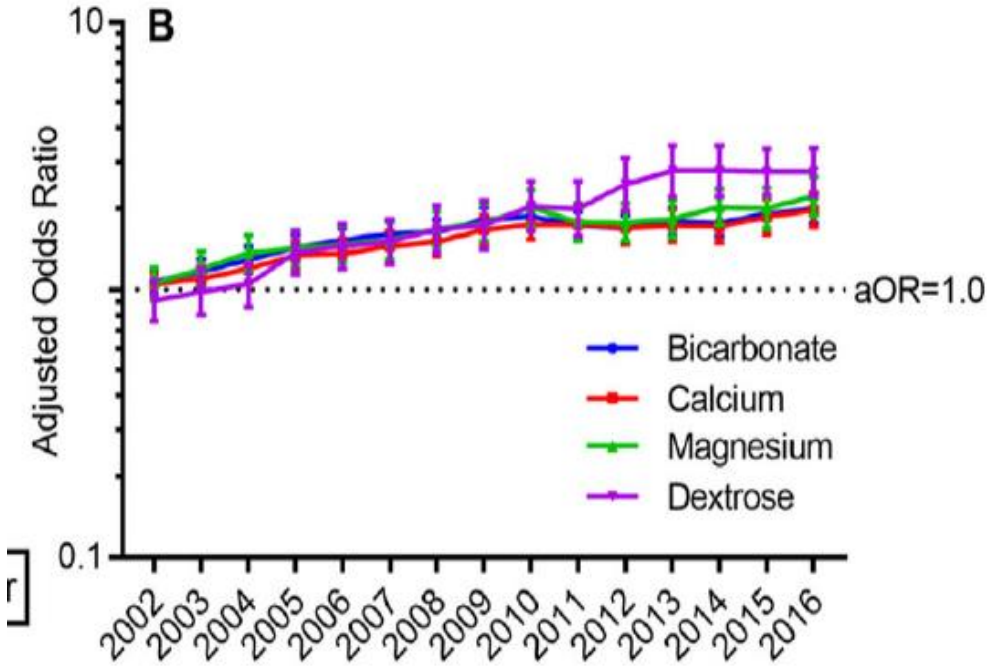
Trends Over Time in Drug Administration During Adult In-Hospital Cardiac Arrest*

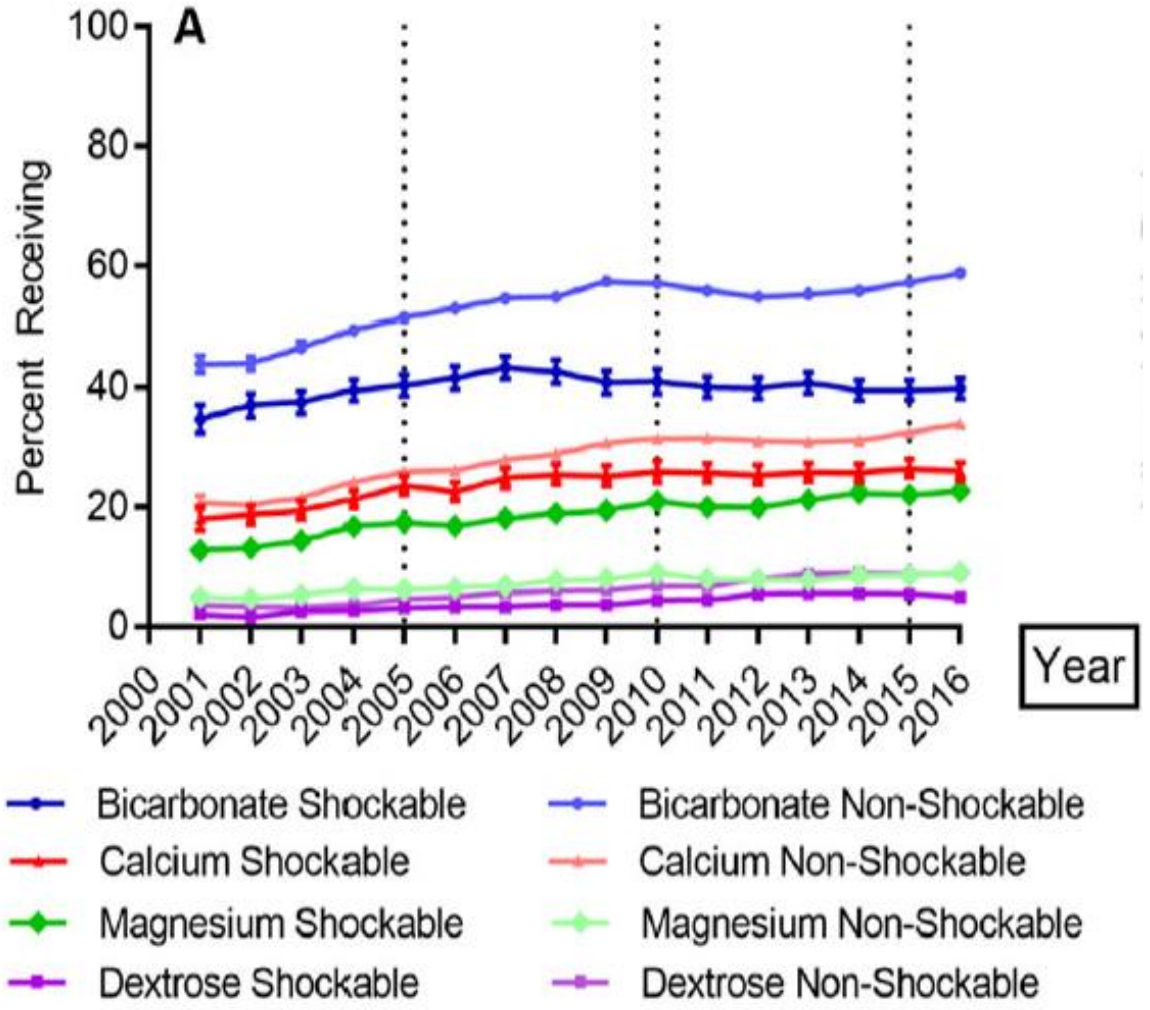
Moskowitz, Ari MD[1]; Ross, Catherine E. MD[2]; Andersen, Lars W. MD, MPH, PhD, DMSc[3]; Grossestreuer, Anne V. PhD[4]; Berg, Katherine M. MD[1]; Donnino, Michael W. MD[1,4]; for the American Heart Association's Get With The Guidelines – Resuscitation Investigators

Author Information

Critical Care Medicine: February 2019 - Volume 47 - Issue 2 - p 194-200

Calcium OR 2.0 entre 2001 et 2016



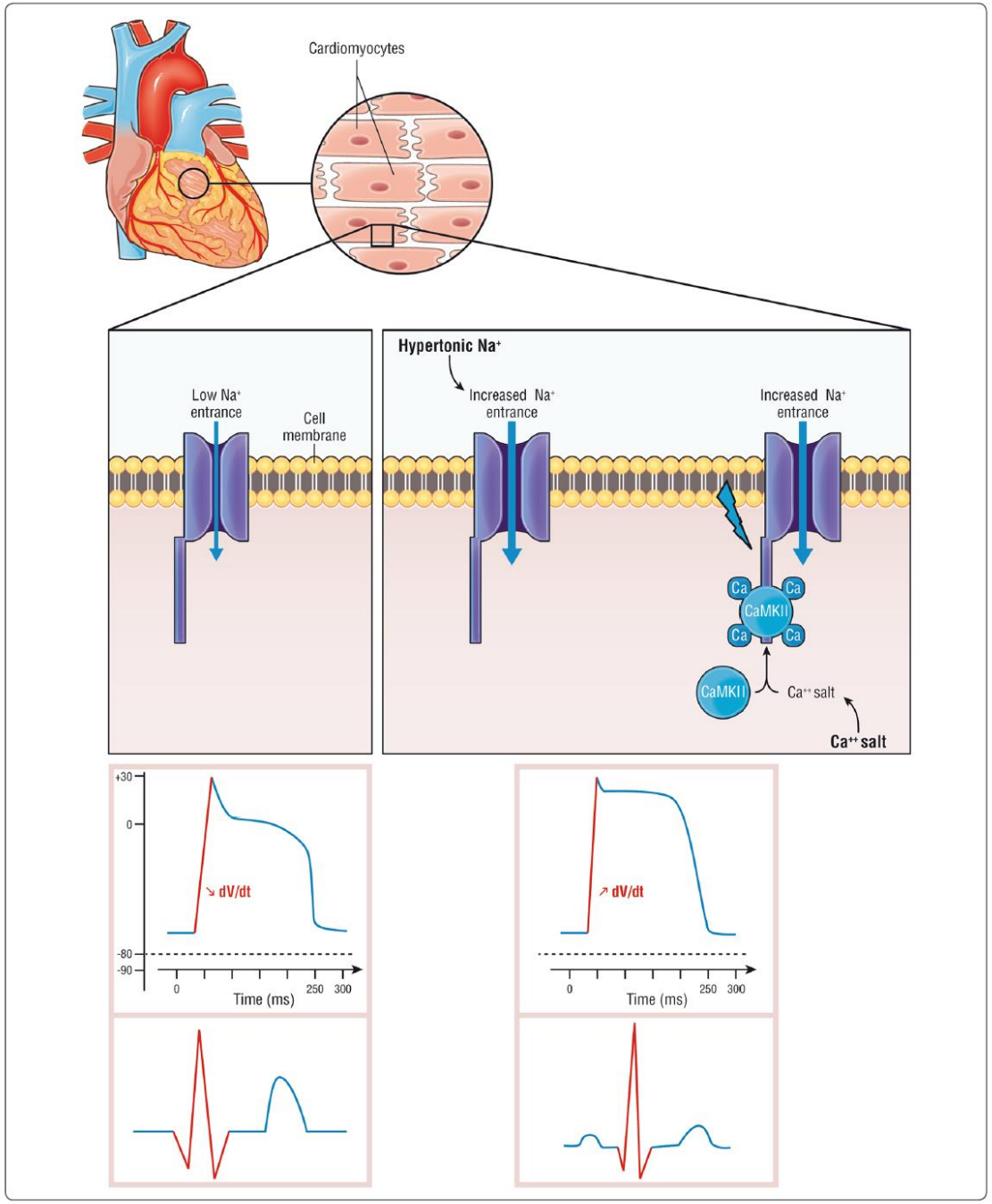


Mécanisme Ca et Hyperkaliémie

Fig. 3.

Fig. 5.

Chamberlain, M. J. (1964). *EMERGENCY TREATMENT OF HYPERKALÆMIA. The Lancet, 283(7331), 464–467.*



Dépret et al. Ann. Intensive Care (2019) 9:32

JAMA | Original Investigation

Effect of Intravenous or Intraosseous Calcium vs Saline on Return of Spontaneous Circulation in Adults With Out-of-Hospital Cardiac Arrest

A Randomized Clinical Trial

Mikael Fink Vallentin, MD; Asger Granfeldt, MD, PhD, DMSc; Carsten Meilandt, BSc; Amalie Ling Povlsen, BSc; Birthe Sindberg, RN; Mathias J. Holmberg, MD, MPH, PhD; Bo Nees Iversen, MD; Rikke Mærkedahl, MD; Lone Riis Mortensen, MD; Rasmus Nyboe, MD; Mads Partridge Vandborg, MD; Maren Tarpgaard, MD; Charlotte Runge, MD, PhD; Christian Fynbo Christiansen, MD, PhD; Thomas H. Dissing, MD, PhD; Christian Juhl Terkelsen, MD, PhD, DMSc; Steffen Christensen, MD, PhD; Hans Kirkegaard, MD, PhD, DMSc; Lars W. Andersen, MD, MPH, PhD, DMSc

POPULATION

277 Men
114 Women

Adults with out-of-hospital cardiac arrest

Mean age: 68 years

LOCATIONS

1 Emergency medical services system in Denmark

INTERVENTION

397 Patients randomized
391 Patients analyzed

193

198

Calcium

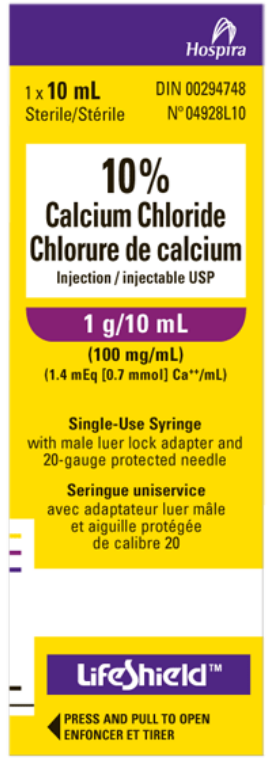
Up to 2 doses of intravenous or intraosseous calcium chloride, 5 mmol (after epinephrine)

Saline

Up to 2 doses of intravenous or intraosseous saline (9 mg/mL of sodium chloride) (after epinephrine)

PRIMARY OUTCOME

Sustained return of spontaneous circulation



RACS

Calcium

19%

N=37/193

Reduction relative
-7.6 (-16 to 0.8)
P=0,09

Placebo

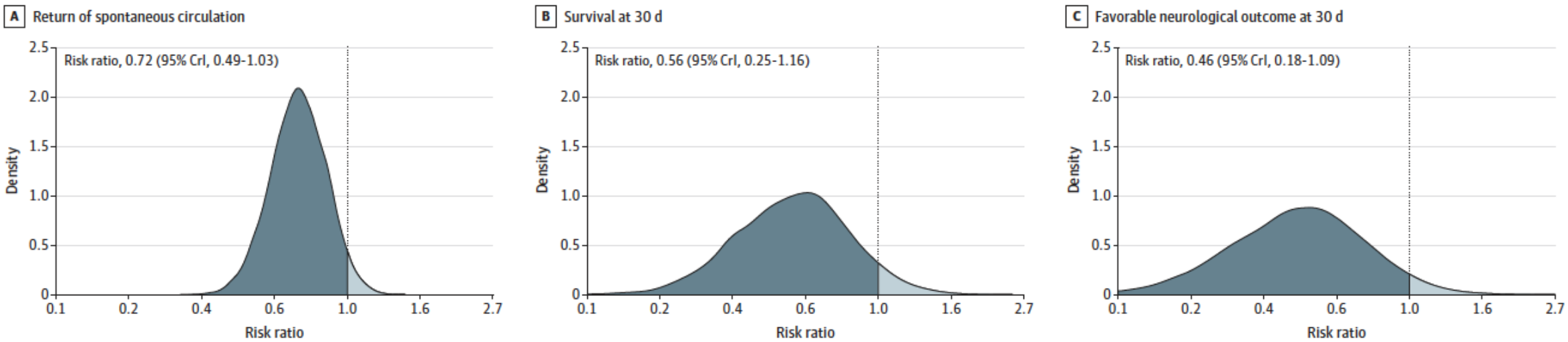
27%

N=53/198

Effect of Intravenous or Intraosseous Calcium vs Saline on Return of Spontaneous Circulation in Adults With Out-of-Hospital Cardiac Arrest
A Randomized Clinical Trial

Mikael Fink Vallentin, MD; Asger Granfeldt, MD, PhD, DMSc; Carsten Meilandt, BSc; Amalie Ling Povlsen, BSc; Birthe Sindberg, RN; Mathias J. Holmberg, MD, MPH, PhD; Bo Nees Iversen, MD; Rikke Mærkedahl, MD; Lone Riis Mortensen, MD; Rasmus Nyboe, MD; Mads Partridge Vandborg, MD; Maren Tarpgaard, MD; Charlotte Runge, MD, PhD; Christian Fynbo Christiansen, MD, PhD; Thomas H. Dissing, MD, PhD; Christian Juhl Terkelsen, MD, PhD, DMSc; Steffen Christensen, MD, PhD; Hans Kirkegaard, MD, PhD, DMSc; Lars W. Andersen, MD, MPH, PhD, DMSc

Figure 3. Posterior Probability Distributions Based on Noninformative Priors

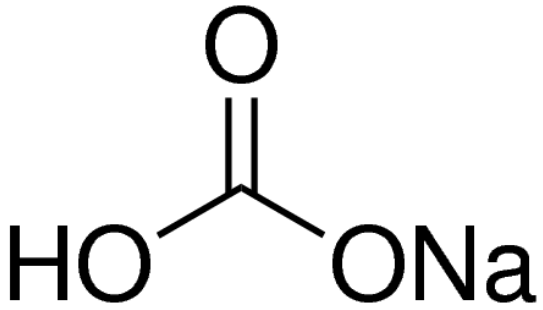


Calcium Intérêts per RCP

- Pas d’intérêt pour AC hors cas particulier
- Hyperkaliémie : Chlorure de Ca : 5 à 10 ml à 10%
- Intoxications (inhibiteurs calciques) : 10 ml à 10% toutes les 2-3 min jusqu’à 50ml

Gluconate de Ca = Chlorure de Ca x 3

Bicarbonates



Effets physiologique :

Hypernatrémie

Alcalose (mais acidose intra-cellulaire)

Effet inotrope négatif et ↘ tonus vasculaire

↑ Capnie : œdème cérébral et ↘ tonus vasculaire cérébrale

Alshahrani and Aldandan *International Journal of Emergency Medicine* (2021) 14:21
https://doi.org/10.1186/s12245-021-00344-x

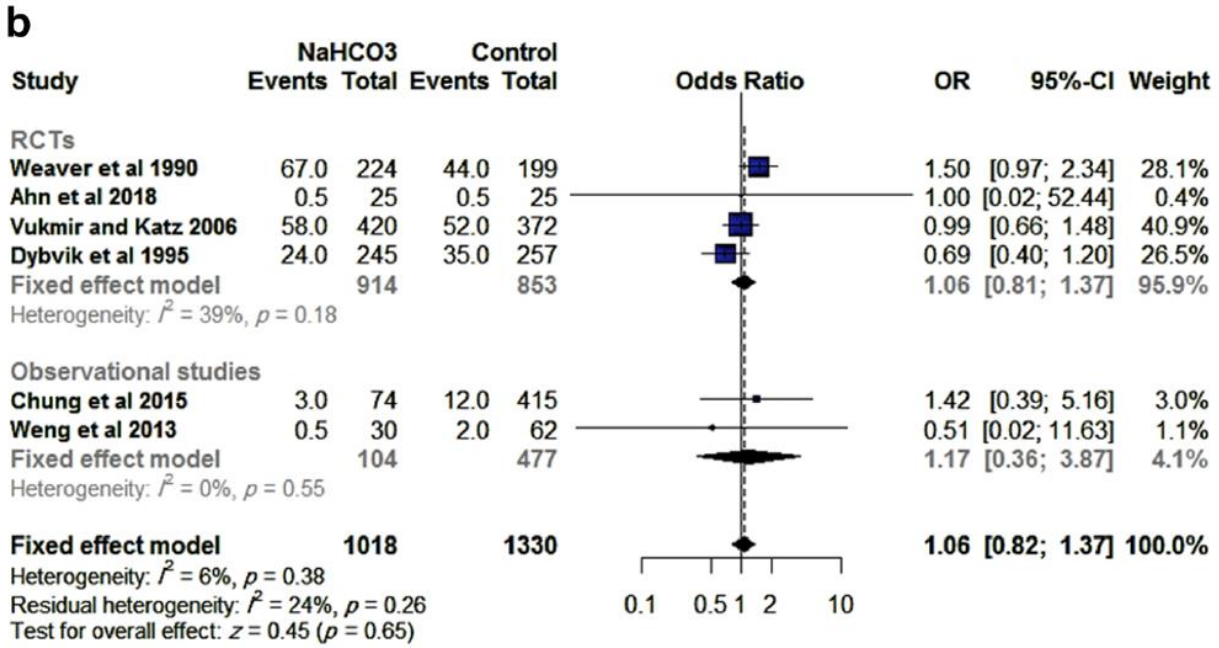
International Journal of Emergency Medicine

ORIGINAL RESEARCH Open Access

Use of sodium bicarbonate in out-of-hospital cardiac arrest: a systematic review and meta-analysis

Mohammed S. Alshahrani[1] and Hassan W. Aldandan[2*]

Effet sur survie



Alshahrani and Aldandan *International Journal of Emergency Medicine* (2021) 14:21
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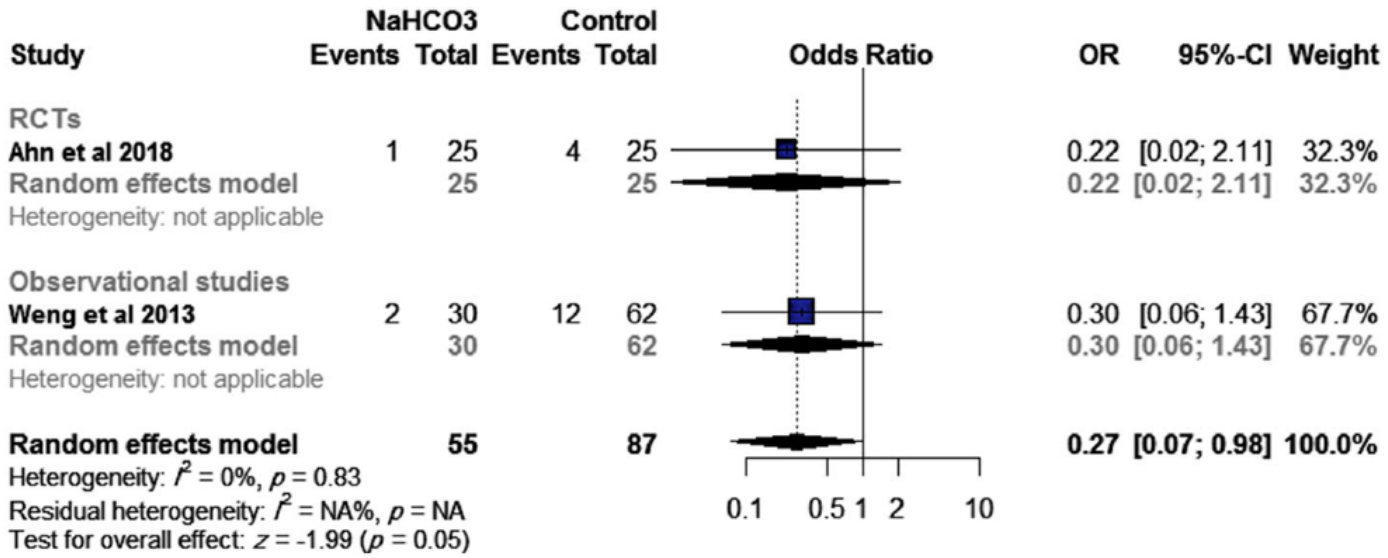
International Journal of Emergency Medicine

ORIGINAL RESEARCH Open Access

Use of sodium bicarbonate in out-of-hospital cardiac arrest: a systematic review and meta-analysis

Mohammed S. Alshahrani[1] and Hassan W. Aldandan[2*]

Effet sur RACS



Effect of sodium bicarbonate on functional outcome in patients with out-of-hospital cardiac arrest: a post-hoc analysis of a French and North-American dataset

Touron, Maxime[a]; Javaudin, François[b]; Lebastard, Quentin[b]; Baert, Valentine[c,d]; Heidet, Mathieu[e]; Hubert, Hervé[c,d]; Leclere, Brice[f]; Lascarrou, Jean-Baptiste[a,g,h]; for the RéAC Network

Author Information

European Journal of Emergency Medicine: June 2022 - Volume 29 - Issue 3 - p 210-220
doi: 10.1097/MEJ.0000000000000918

Réac : Bicar vs. no Bicar
CPC 1-2 : OR 0.91 (95%CI, 0.50–1.65)
Survie : OR 0.89 (0.52–1.53)

2 bases de données Réac et Nord-américaine
6136 patients

USA : Bicar vs. no Bicar
CPC 1-2 : OR 0.45 (95%CI, 0.34–0.58
Survie : OR 0.59 (95%CI, 0.47–0.73)

Bicarbonates : Intérêts ?

- Pas d'intérêt dans l'AC en dehors cas particuliers
- Hyperkaliémie : 50 ml de bicarbonates à 8,4% en IV rapide
- Hyperthermie maligne : à considérer si acidose sévère
- Intoxications (quinidine like, stabilisants de membrane)

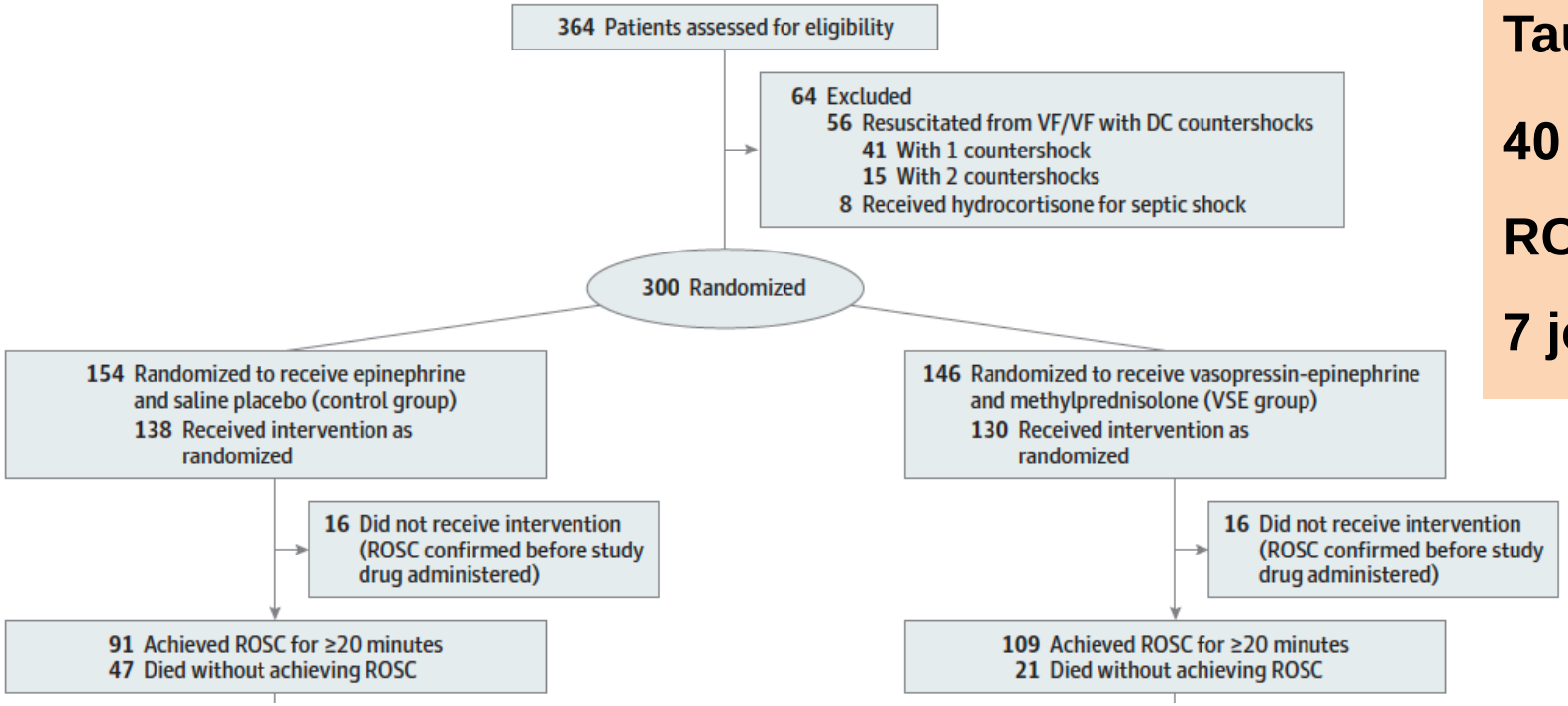
Corticoïdes per RCP

Vasopressin, Steroids, and Epinephrine and Neurologically Favorable Survival After In-Hospital Cardiac Arrest

A Randomized Clinical Trial

Spyros D. Mentzelopoulos, MD, PhD; Sotirios Malachias, MD; Christos Chamos, MD; Demetrios Konstantopoulos, MD; Theodora Ntaidou, MD; Androula Papastylianou, MD, PhD; Iosifinia Kolliantzaki, MD; Maria Theodoridi, MD; Helen Ischaki, MD, PhD; Demosthenes Makris, MD, PhD; Epaminondas Zakynthinos, MD, PhD; Elias Zintzaras, MD, PhD; Sotirios Sourlas, MD; Stavros Aloizos, MD; Spyros G. Zakynthinos, MD, PhD

JAMA. 2013;310(3):270-279



RCT 3 centres en grèce

Taux de RACS : 75%

40 mg d'hydrocortisone per RCP puis 300 mg/j pendant 7 jours

Survie à la sortie de l'hôpital CPC 1-2

Adrénaline-Vasopressine-Corticoïde

13,8%

N=18/130

Odds Ratio
3,28 (IC95% 1,17-9,20)
P=0,02

Placebo

5,1%

N=7/138

JAMA | Original Investigation

Effect of Vasopressin and Methylprednisolone vs Placebo on Return of Spontaneous Circulation in Patients With In-Hospital Cardiac Arrest
A Randomized Clinical Trial

Lars W. Andersen, MD, MPH, PhD, DMSc; Dan Isbye, MD, PhD; Jesper Kjærgaard, MD, PhD, DMSc;

JAMA. 2021;326(16):1586-1594

POPULATION

322 Men
179 Women

Adults with in-hospital cardiac arrest

Mean age: 71 years

LOCATIONS

10 Hospitals in Denmark

POPULATION

322 Men
179 Women

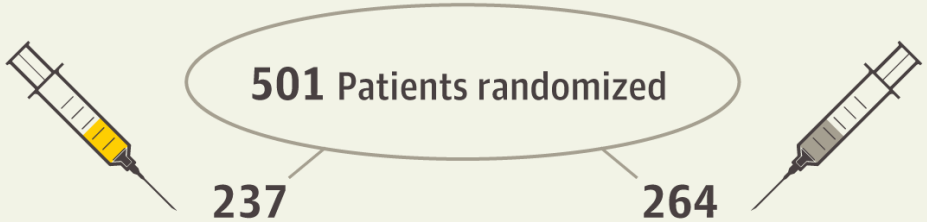
Adults with in-hospital cardiac arrest

Mean age: 71 years

LOCATIONS

10 Hospitals in Denmark

INTERVENTION



Vasopressin + methylprednisolone
Methylprednisolone, 40 mg, and vasopressin, 20 IU, given after epinephrine (vasopressin given up to 4 doses)

Placebo
Sodium chloride, 9 mg/mL

PRIMARY OUTCOME

Return of spontaneous circulation, defined as spontaneous circulation with no further need for chest compressions sustained for at least 20 minutes

CPJ : RACS

Corticoïde + Vasopressine

42%

N=100/237

Risk Ratio
1.30 (1.03 to 1.63)
P=0,03

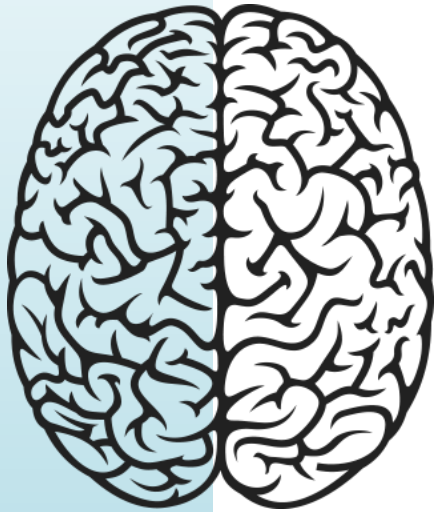
Placebo

33%

N=86/264

Bon devenir neurologique à 90J

Corticoïde + Vasopressine



Placebo

7,6%

N=18/237

Différence
0.0
(−4.7 to 4.9)

7,6%

N=20/264

Review

Vasopressin and glucocorticoids for in-hospital cardiac arrest: A systematic review and meta-analysis of individual participant data

Mathias J. Holmberg[a,b,c], *Asger Granfeldt*[b,d], *Spyros D. Mentzelopoulos*[e], *Lars W. Andersen*[a,b,d,f,*]

RESUSCITATION 171 (2022) 48–56

Available online at ScienceDirect

Resuscitation

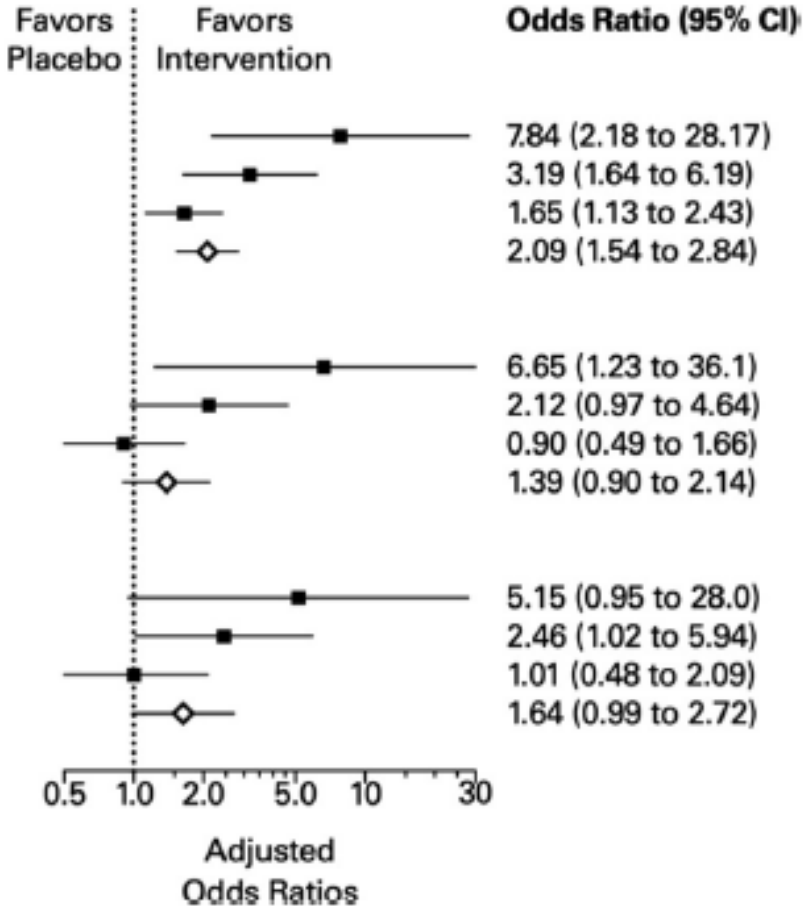
journal homepage: www.elsevier.com/locate/resuscitation

EUROPEAN RESUSCITATION COUNCIL

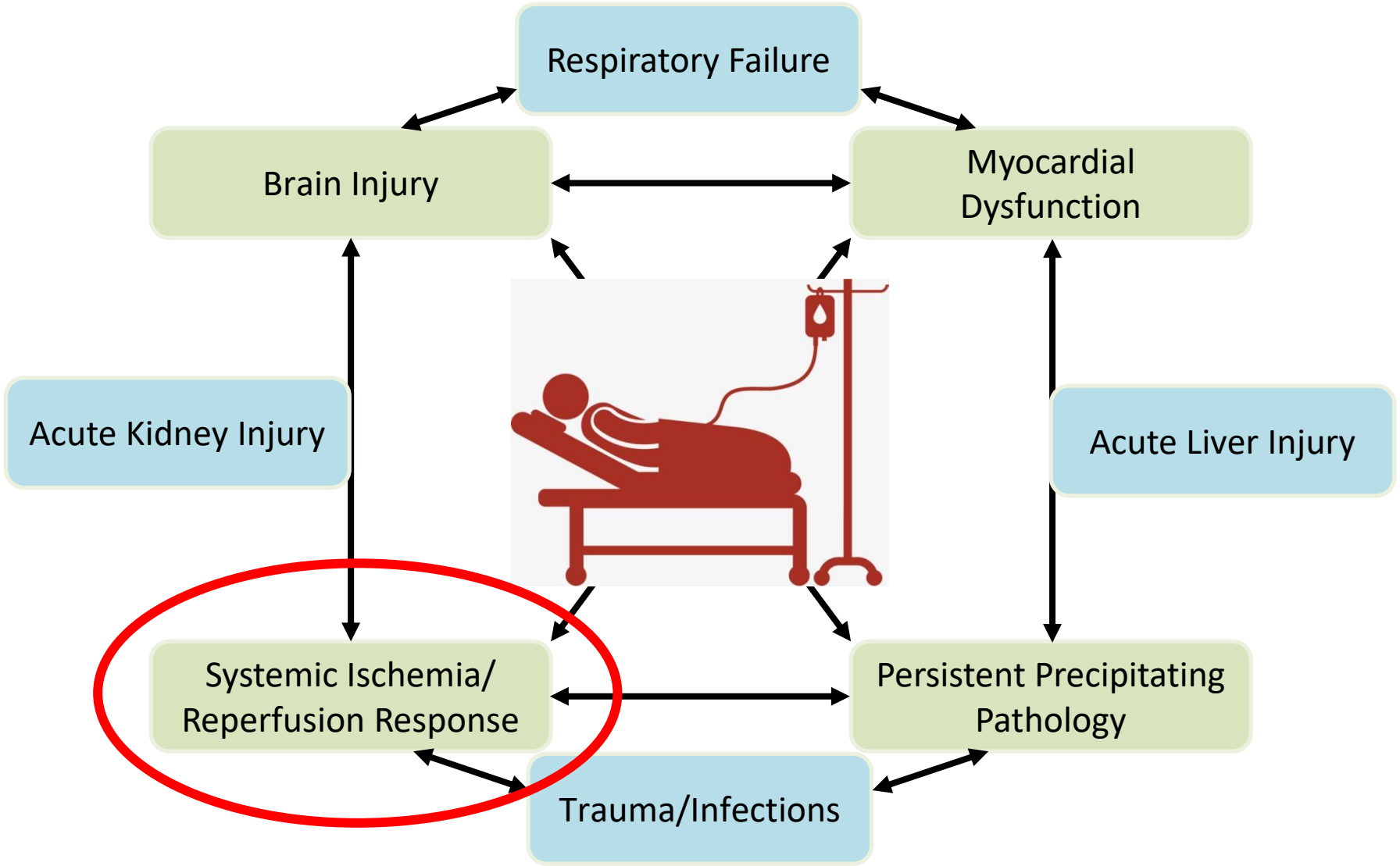
Individual Participant Data Meta-Analyses

Outcome	Placebo	Intervention	Odds Ratio (95% CI)
ROSC			
Mentzelopoulos et al. 2009	27 (52%)	39 (81%)	7.84 (2.18 to 28.17)
Mentzelopoulos et al. 2013	91 (66%)	109 (84%)	3.19 (1.64 to 6.19)
Andersen et al. 2021	86 (33%)	100 (42%)	1.65 (1.13 to 2.43)
Fixed effects model	204 (45%)	248 (60%)	2.09 (1.54 to 2.84)
Survival at hospital discharge			
Mentzelopoulos et al. 2009	2 (4%)	9 (19%)	6.65 (1.23 to 36.1)
Mentzelopoulos et al. 2013	11 (8%)	20 (15%)	2.12 (0.97 to 4.64)
Andersen et al. 2021	32 (12%)	24 (10%)	0.90 (0.49 to 1.66)
Fixed effects model	45 (10%)	53 (13%)	1.39 (0.90 to 2.14)
CPC 1—2 at hospital discharge			
Mentzelopoulos et al. 2009	2 (4%)	8 (17%)	5.15 (0.95 to 28.0)
Mentzelopoulos et al. 2013	8 (6%)	17 (13%)	2.46 (1.02 to 5.94)
Andersen et al. 2021	19 (7%)	16 (7%)	1.01 (0.48 to 2.09)
Fixed effects model	29 (6%)	41 (10%)	1.64 (0.99 to 2.72)

I^2: ROSC 63%; Survival 73%; CPC 61%



Syndrome post arrêt cardiaque



Corticoïdes - intérêts post RACS

Donnino *et al. Critical Care* (2016) 20:82
DOI 10.1186/s13054-016-1257-x

Critical Care

RESEARCH Open Access

Corticosteroid therapy in refractory shock following cardiac arrest: a randomized, double-blind, placebo-controlled, trial

Michael W. Donnino[1,2*], Lars W. Andersen[1,3,10], Katherine M. Berg[2], Maureen Chase[1], Robert Sherwin[4],

50 patients randomisés

CPJ : Délai pour la réversion de l'état de choc

	Corticoïde		Placebo
	55 heures	Odds Ratio 0.83 [95 % CI: 0.40-1.75] p = 0.63	49 heures
Reversion du choc	52% N=13/25	P=0,78	60% N=15/25

Survie à la sortie de l'hôpital CPC 1-2

Corticoïde

24%

N=6/25

P=0,75

Placebo

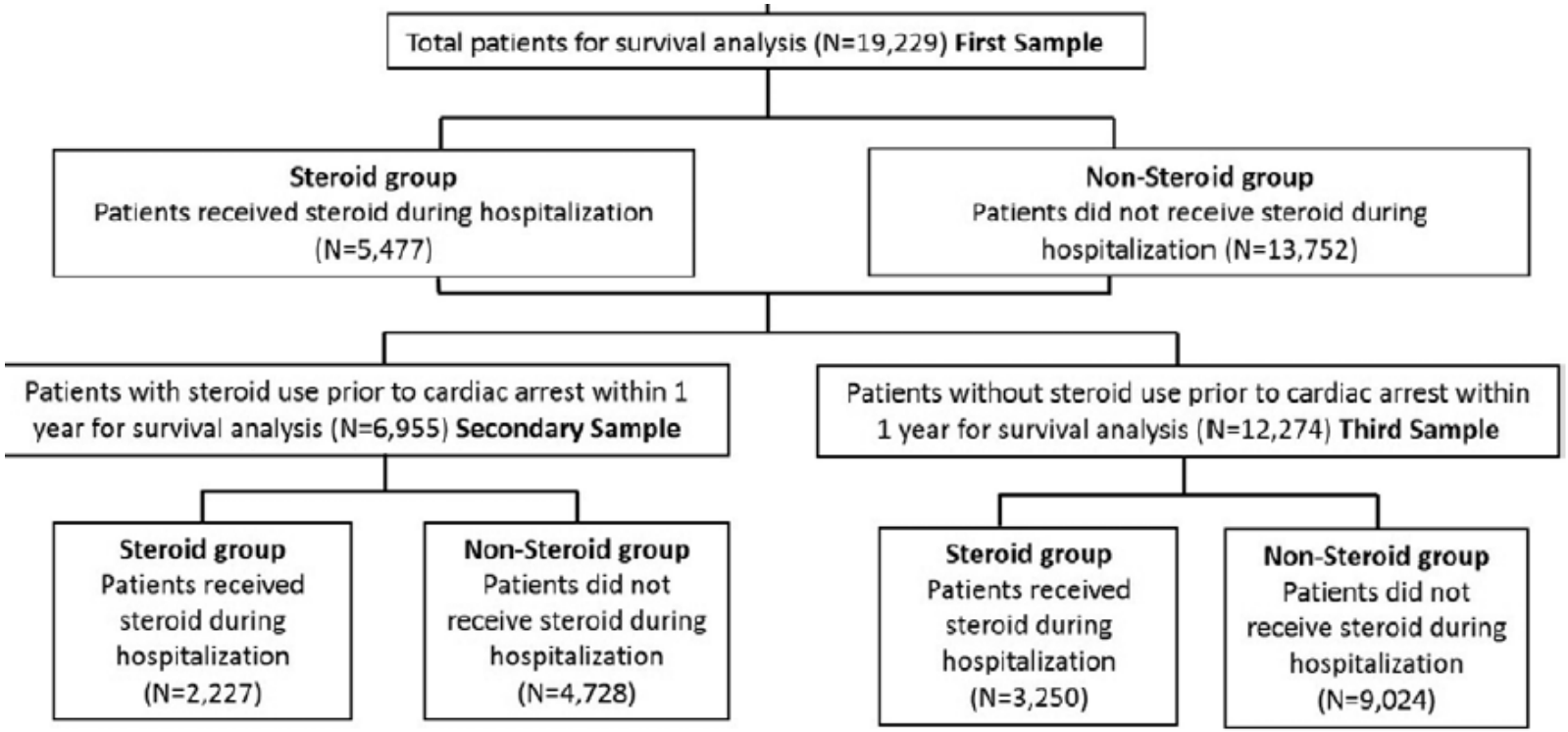
32%

N=8/25

Postarrest Steroid Use May Improve Outcomes of Cardiac Arrest Survivors

CCM 2018

Min-Shan Tsai, MD, PhD[1,2]; Po-Ya Chuang, MHA[3]; Chien-Hua Huang, MD, PhD[1]; Chao-Hsiun Tang, PhD[3]; Ping-Hsun Yu, MD[4]; Wei-Tien Chang, MD, PhD[1]; Wen-Jone Chen, MD, PhD[1,5]



Etude rétrospective

19 229 patients

40% avait eu des corticoides avant l'AC

Diminution de la Mortalité

	Corticoïde		Placebo
Mortalité à la sortie de l'hôpital	**76%** N=4119/5445	**Adjusted Odds Ratio 0.74 [95 % CI: 0.70-0.77]**	**81%** N=4403/5445
Mortalité à un an	**84%** N=4549/5445	**Adjusted Odds Ratio 0.73 [95 % CI: 0.70-0.76]**	**88%** N=4779/5445

Postarrest Steroid Use May Improve Outcomes of Cardiac Arrest Survivors

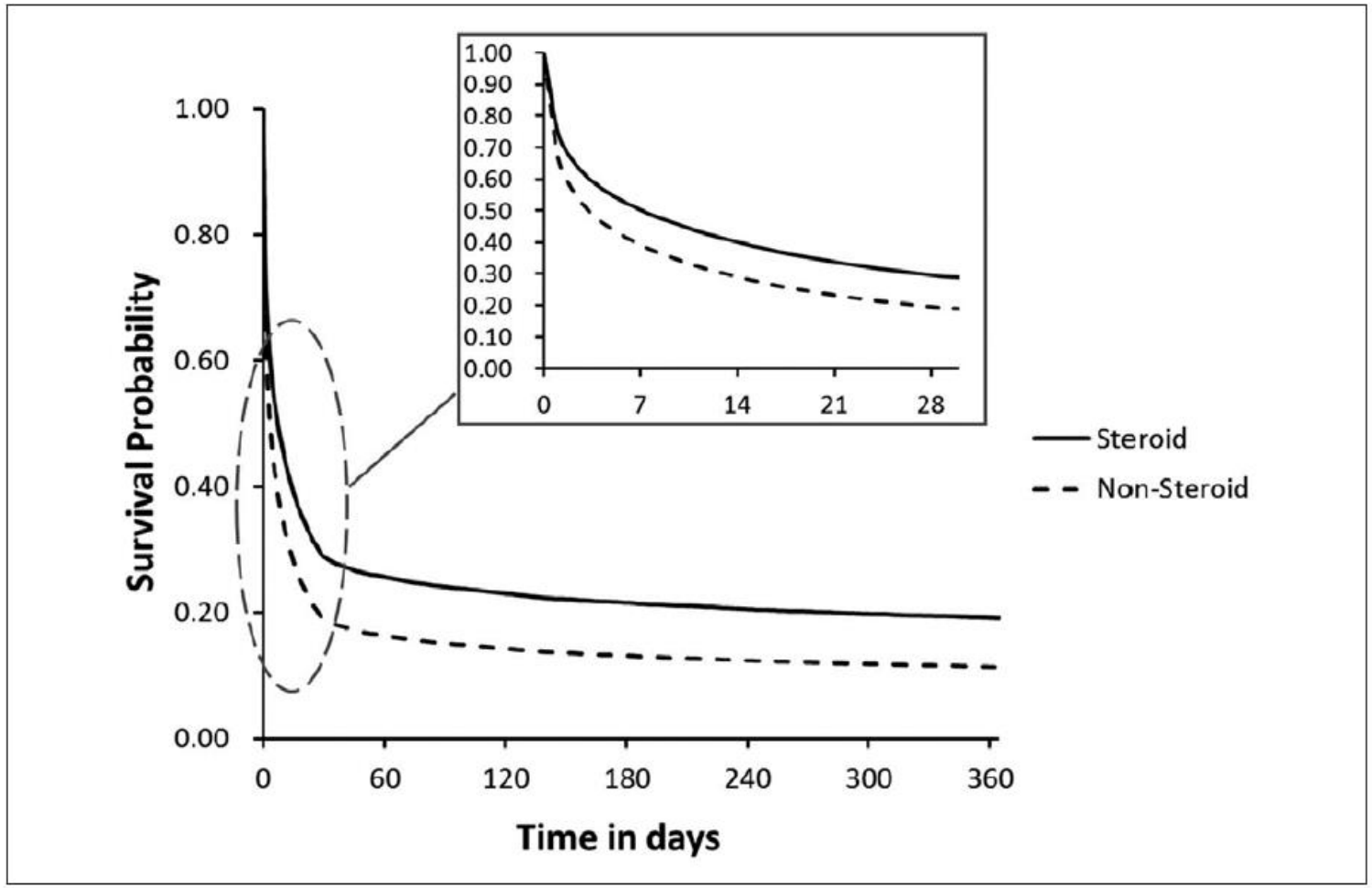


Figure 2. The 1-yr survival curves of the groups. There is a significant difference between these groups ($p < 0.0001$).

Faible dose < 50 mg/j avait un meilleur pronostic que dose > 50mg/j

Conclusion

- **Hypothermie** : pas de réplication des modèles animaux. Intérêt d'une hypothermie très précoce ?
- **Calcium et bicarbonates** : peu d'intérêt en dehors circonstances particulières
- **Vasopressine + corticoïdes** → ↑ RACS
- Piste de recherche intéressante en post RACS pour les corticoïdes