Thérapeutiques invasives dans l'arrêt cardiaque : ECMO, REBOA

Journée Urg'ARA
Thématique Don d'Organes

02 décembre 2024

Dr Nicolas SEGOND
Urgences – SAMU – SMUR
CHU Grenoble-Alpes

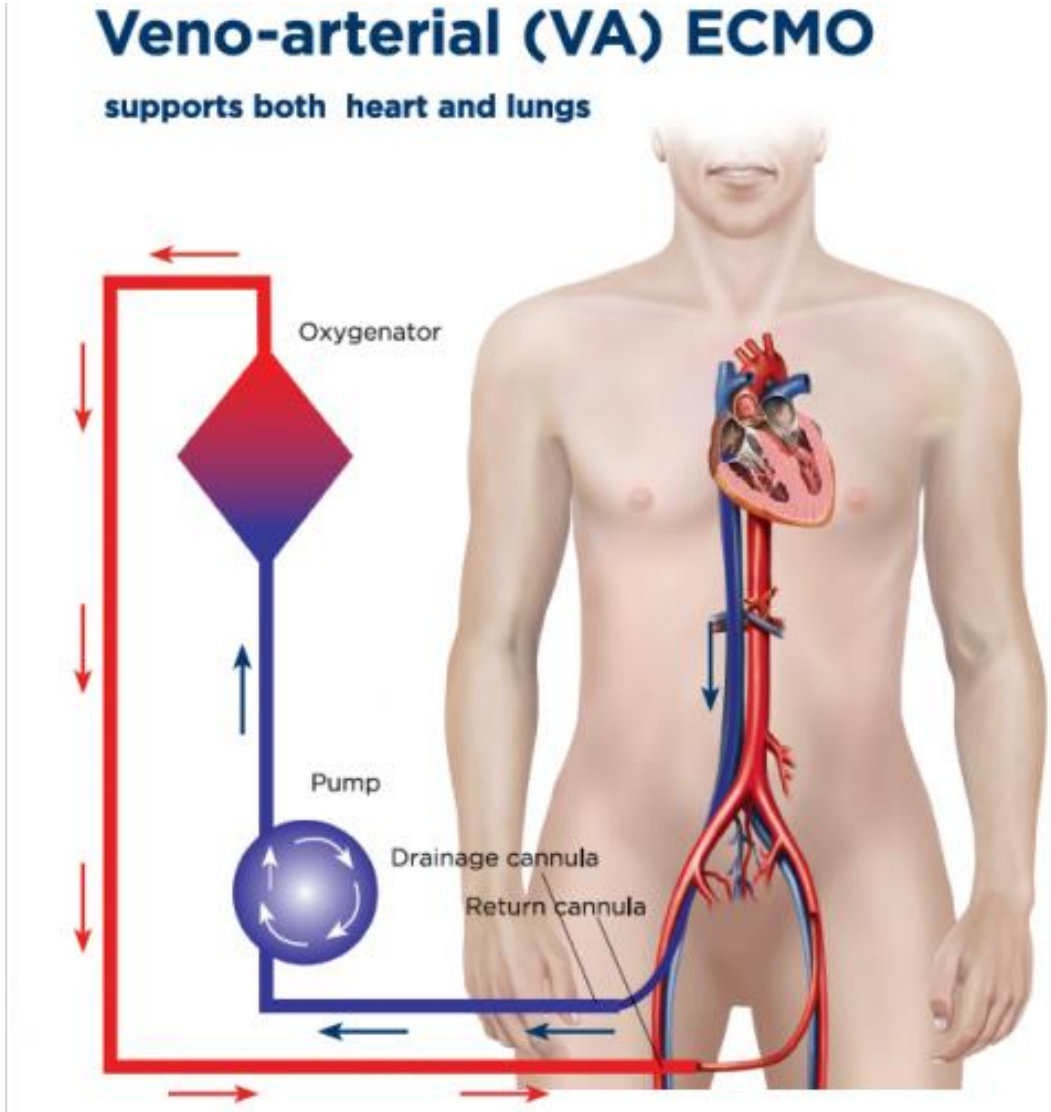
Programme

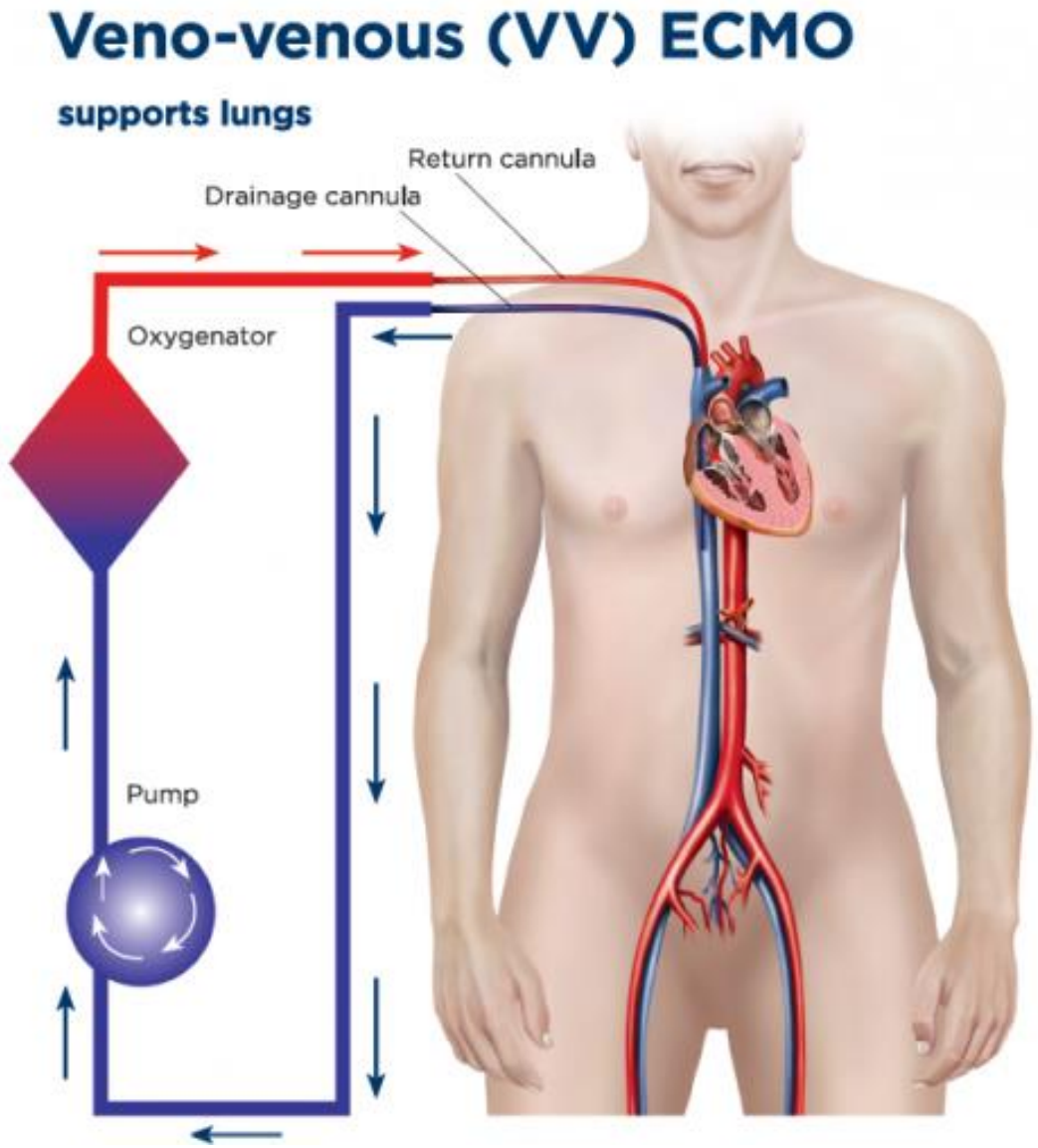
But : mise au point sur les dernières avancées des thérapeutiques invasives dans l'arrêt cardiaque.

- **ECMO**
- **REBOA**
- **Synthèse / Place du don d'organes**

ECMO

Principe de l'ECMO





En préhospitalier …

PARIS MATCH

SANTÉ

Samu : avec l'Ecmo, les urgentistes réveillent les « morts »

En préhospitalier …

Lyon : Le SAMU ressuscite certaines victimes d'arrêt cardiaque grâce à une nouvelle technique réalisable en dehors de l'hôpital

MEDECINE · Depuis septembre 2017, quatre patients victimes d'arrêt cardiaque ont été sauvés par le SAMU de Lyon grâce à une nouvelle technique de réanimation, réalisable en dehors de l'hôpital…

Et l’EBM ?

3 études cliniques d'importance

THE LANCET

Advanced reperfusion strategies for patients with out-of-hospital cardiac arrest and refractory ventricular fibrillation (ARREST): a phase 2, single centre, open-label, randomised controlled trial

Demetris Yannopoulos, Jason Bartos, Ganesh Raveendran, Emily Walser, John Connett, Thomas A Murray, Gary Collins, Lin Zhang, Rajat Kalra, Marinos Kosmopoulos, Ranjit John, Andrew Shaffer, R J Frascone, Keith Wesley, Marc Conterato, Michelle Biros, Jakub Tolar, Tom P Aufderheide

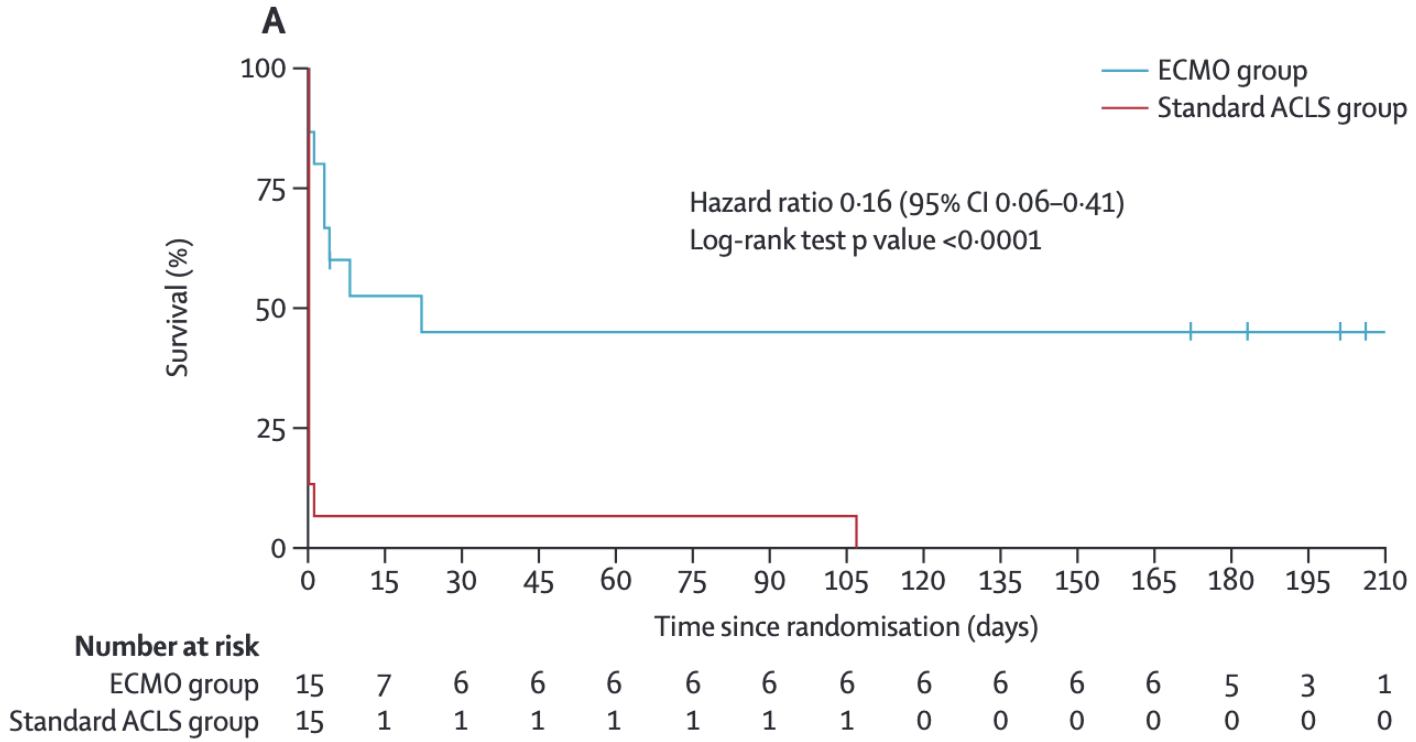
ARREST Trial

ARREST Trial

Etude monocentrique Minneapolis, USA

ECMO à l'hôpital, 60 min

29 patients inclus, 14 ECMO / 15 RCP standard



3 études cliniques d'importance

JAMA®
The Journal of the American Medical Association

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effect of Intra-arrest Transport, Extracorporeal Cardiopulmonary Resuscitation, and Immediate Invasive Assessment and Treatment on Functional Neurologic Outcome in Refractory Out-of-Hospital Cardiac Arrest
A Randomized Clinical Trial

Jan Belohlavek, MD, PhD; Jana Smalcova, MD; Daniel Rob, MD; Ondrej Franek, MD; Ondrej Smid, MD; Milana Pokorna, MD, PhD; Jan Horák, MD; Vratislav Mrazek, MD; Tomas Kovarnik, MD, PhD; David Zemanek, MD, PhD; Ales Kral, MD, PhD; Stepan Havranek, MD, PhD; Petra Kavalkova, PhD; Lucie Kompelentova, MD; Helena Tomková, MD; Alan Mejstrik, MSc; Jaroslav Valasek, MD; David Peran, MSc; Jaroslav Pekara, MSc; Jan Rulisek, MD, PhD; Martin Balik, MD, PhD; Michal Huptych, PhD; Jiri Jarkovsky, PhD; Jan Malik, MD, PhD; Anna Valerianova, MD, PhD; Frantisek Mlejnsky, MSc, PhD; Petr Kolouch, MD; Petra Havrankova, MD, PhD; Dan Romportl, MD; Arnost Komarek, PhD; Ales Linhart, MD, PhD; for the Prague OHCA Study Group

PRAGUE Trial

PRAGUE Trial

Table 2. Primary and Secondary Outcomes in a Study of Intra-arrest Transport, Extracorporeal Cardiopulmonary Resuscitation, and Immediate Invasive Assessment and Treatment in Refractory Out-of-Hospital Cardiac Arrest

	No. (%)			
	Invasive strategy (n = 124)	Standard strategy (n = 132)	Absolute difference, % (95% CI)	*P* value
Primary outcome				
Survival with minimal or no neurologic impairment at 180 d[a]	39 (31.5)	29 (22.0)	9.5 (−1.3 to 20.1)	.09
Secondary outcomes				
Survival with minimal or no neurologic impairment at 30 d[a]	38 (30.6)	24 (18.2)	12.4 (1.9 to 22.7)	.02
Cardiac recovery at 30 d[b]	54 (43.5)	45 (34.1)	9.4 (−2.5 to 21)	.12

[a] Defined as Cerebral Performance Category 1 or 2. The Cerebral Performance Category schema ranges from 1 (defined as conscious, alert, able to work), 2 (conscious, sufficient cerebral function for independent activities of daily life, able to work in sheltered environment), 3 (conscious, dependent on others for daily support), 4 (comatous, vegetative state) to 5 (defined as brain death). All patients observed to death or 180 days.

[b] Defined as absence of both pharmacological and mechanical cardiac support for at least 24 hours.

3 études cliniques d'importance

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JANUARY 26, 2023 VOL. 388 NO. 4

Early Extracorporeal CPR for Refractory Out-of-Hospital Cardiac Arrest

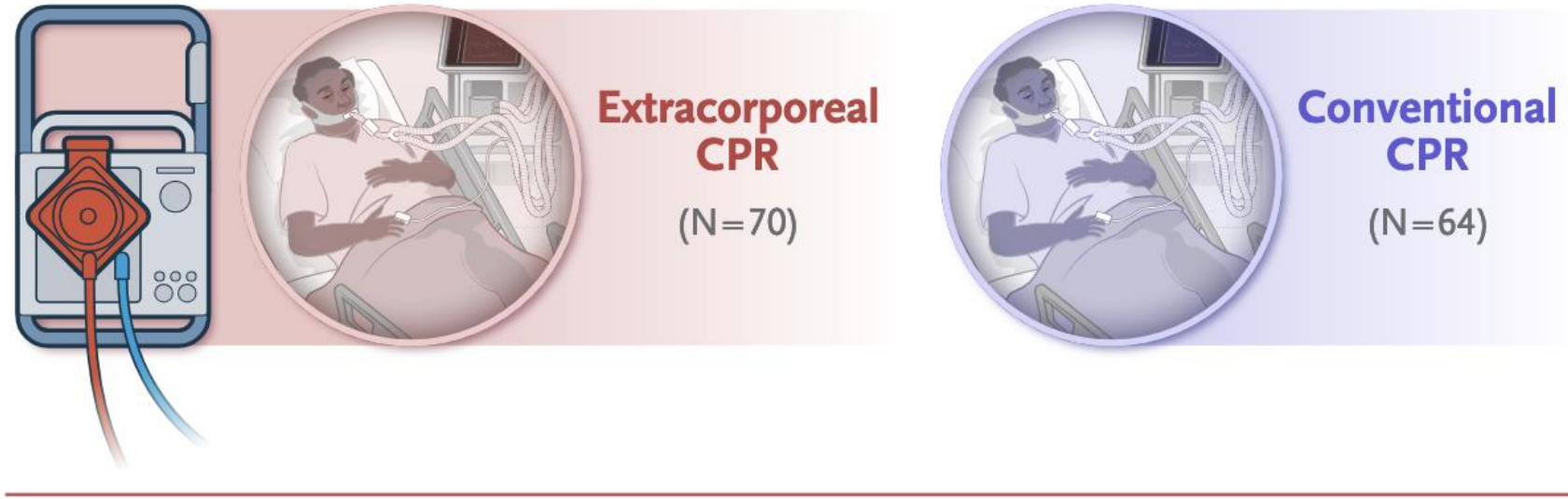
M.M. Suverein, T.S.R. Delnoij, R. Lorusso, G.J. Brandon Bravo Bruinsma, L. Otterspoor, C.V. Elzo Kraemer, A.P.J. Vlaar, J.J. van der Heijden, E. Scholten, C. den Uil, T. Jansen, B. van den Bogaard, M. Kuijpers, K.Y. Lam, J.M. Montero Cabezas, A.H.G. Driessen, S.Z.H. Rittersma, B.G. Heijnen, D. Dos Reis Miranda, G. Bleeker, J. de Metz, R.S. Hermanides, J. Lopez Matta, S. Eberl, D.W. Donker, R.J. van Thiel, S. Akin, O. van Meer, J. Henriques, K.C. Bokhoven, L. Mandigers, J.J.H. Bunge, M.E. Bol, B. Winkens, B. Essers, P.W. Weerwind, J.G. Maessen, and M.C.G. van de Poll

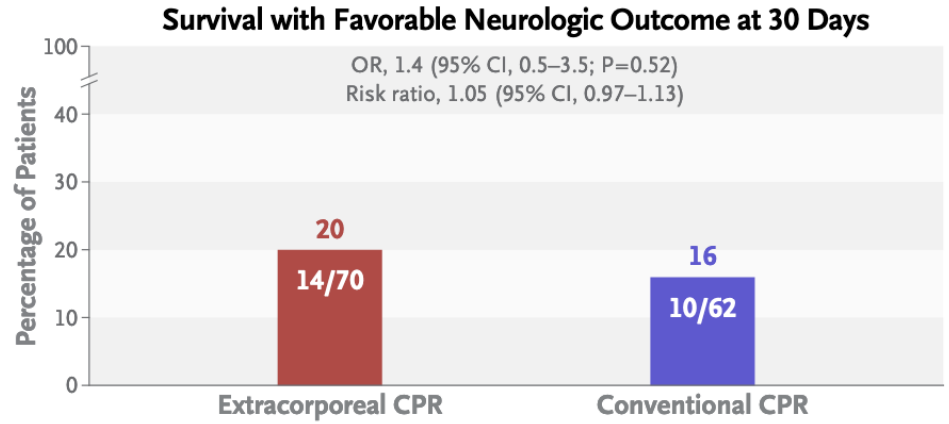
INCEPTION Trial

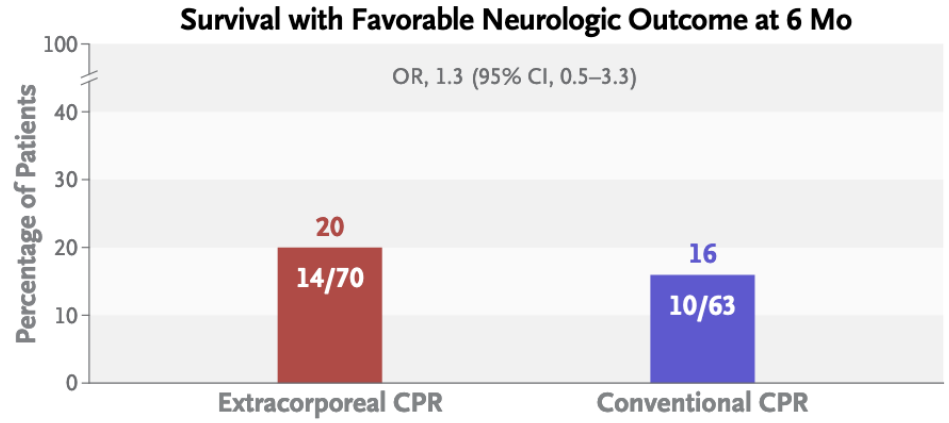
INCEPTION Trial

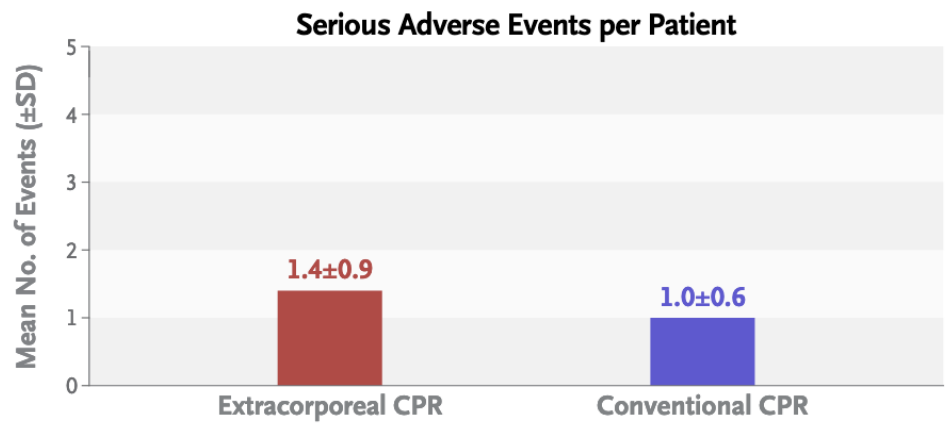
Etude multicentrique Pays-Bas

ECMO à l’hôpital




Survival with Favorable Neurologic Outcome at 30 Days
OR, 1.4 (95% CI, 0.5–3.5; P=0.52)
Risk ratio, 1.05 (95% CI, 0.97–1.13)
Percentage of Patients
100
40
30
20
10
0
20
14/70
16
10/62
Extracorporeal CPR
Conventional CPR


Survival with Favorable Neurologic Outcome at 6 Mo
OR, 1.3 (95% CI, 0.5–3.3)
Percentage of Patients
100
40
30
20
10
0
20
14/70
16
10/63
Extracorporeal CPR
Conventional CPR


Serious Adverse Events per Patient
Mean No. of Events (±SD)
5
4
3
2
1
0
1.4±0.9
1.0±0.6
Extracorporeal CPR
Conventional CPR

Limites

- Centres non experts
- Pas de protocole standardisé de mise en place (différence entre les centres +++)
- Délai de mise en place : 1h15 en moyenne

Méta-analyse

Critical Care

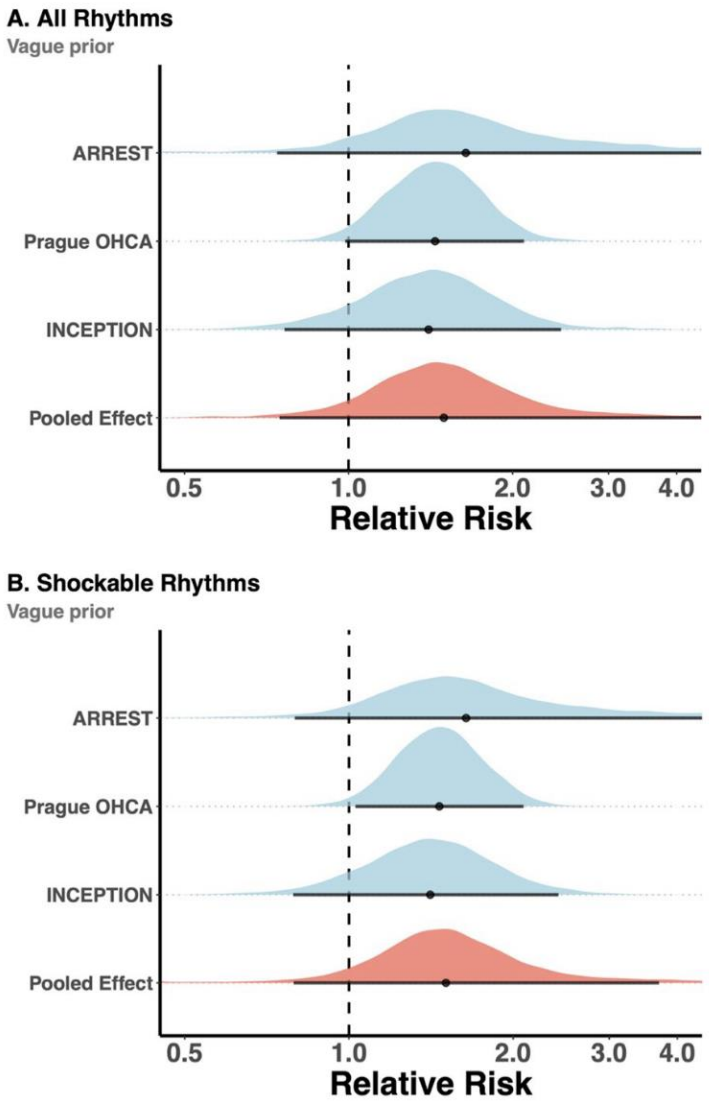


Fig. 2 Primary (**A**) and secondary (**B**) Bayesian meta-analyses of primary outcomes under a vague prior. The black horizontal line denotes 95% credible interval

RESEARCH Open Access

Extracorporeal cardiopulmonary resuscitation versus standard treatment for refractory out-of-hospital cardiac arrest: a Bayesian meta-analysis

Samuel Heuts[1,2*†], Johannes F. H. Ubben[3†], Michal J. Kawczynski[1,2], Andrea Gabrio[4,5], Martje M. Suverein[6], Thijs S. R. Delnoij[6], Petra Kavalkova[7], Daniel Rob[7], Arnošt Komárek[8], Iwan C. C. van der Horst[2,6], Jos G. Maessen[1,2], Demetris Yannopoulos[9†], Jan Bělohlávek[7†], Roberto Lorusso[1,2†] and Marcel C. G. van de Poll[6,10†]

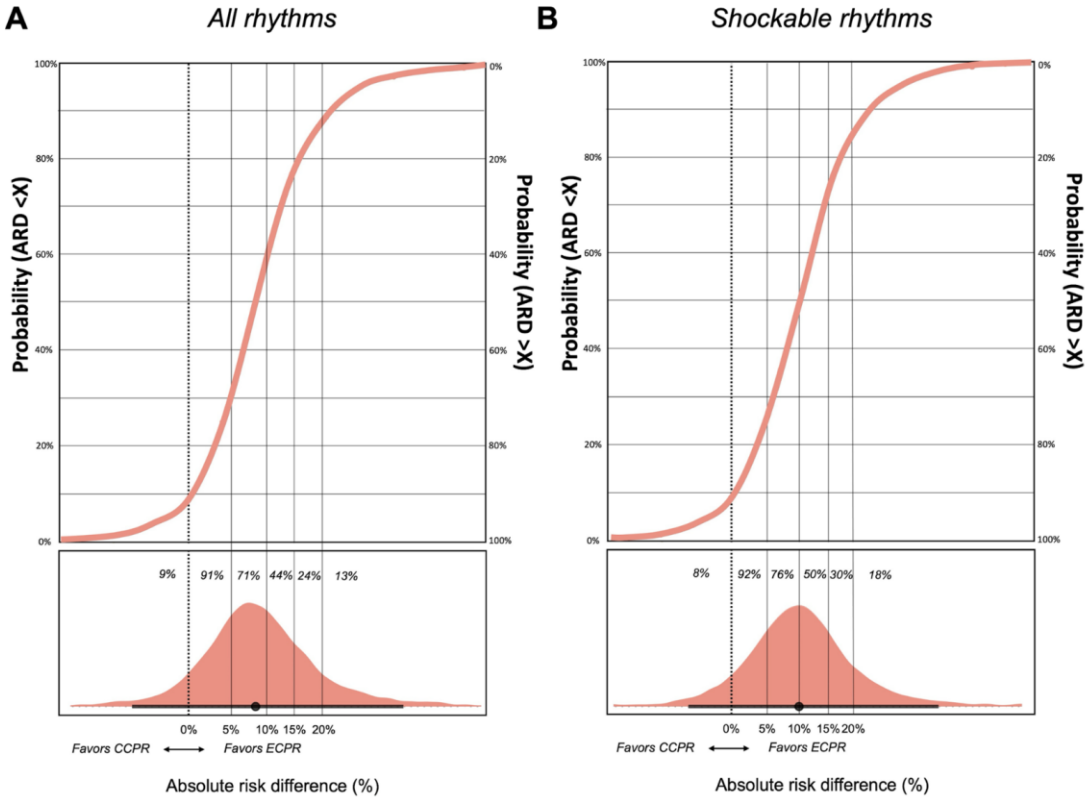


Fig. 3 Full posterior probability distribution of the primary (**A**) and secondary (**B**) Bayesian meta-analyses of the primary outcome under a vague prior. The black horizontal line denotes the 95% credible interval. ARD: absolute risk difference, CCPR: conventional cardiopulmonary resuscitation, ECPR: extracorporeal cardiopulmonary resuscitation

Quel avenir pour l'ECMO ?

- Nécessité d'une expertise
- Préhospitalière vs. Intra-hospitalière → débat à poursuivre
- Patients sélectionnés

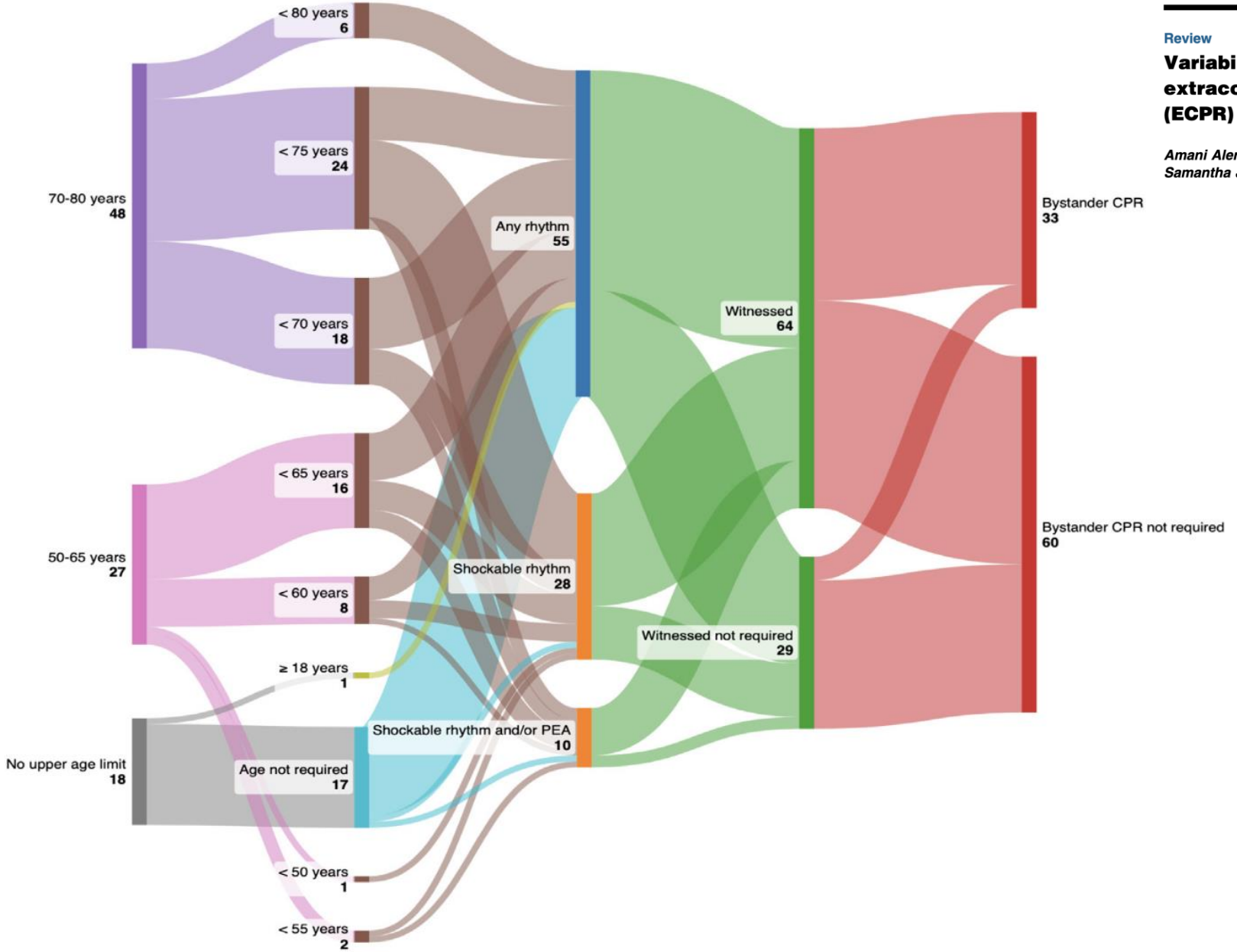
American Heart Association.

2023 AHA

EXTRACORPOREAL CPR

ECPR		
COR	**LOE**	**Recommendation**
2a	B-R	1. Use of ECPR for patients with cardiac arrest refractory to standard ACLS is reasonable in select patients when provided within an appropriately trained and equipped system of care.

Critères de sélection ?



RESUSCITATION 204 (2024) 110403

Available online at ScienceDirect

Resuscitation

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

Review

Variability in patient selection criteria across extracorporeal cardiopulmonary resuscitation (ECPR) systems: A systematic review

Amani Alenazi[a,b,c], *Mohammed Aljanoubi*[a,d], *Joyce Yeung*[a,e], *Jason Madan*[a], *Samantha Johnson*[f], *Keith Couper*[a,e,*]

ECMO et don d'organes

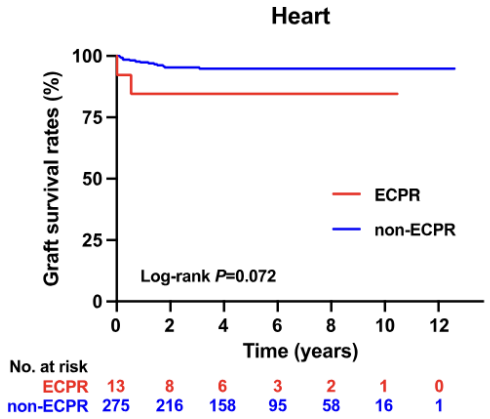
Critical Care

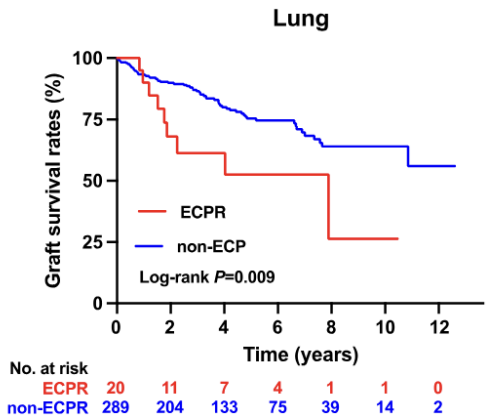
RESEARCH Open Access

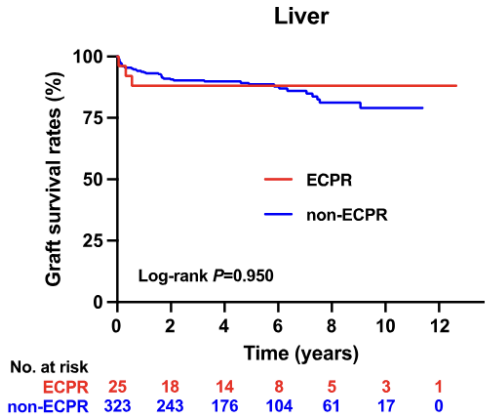
Organ donation after extracorporeal cardiopulmonary resuscitation: a nationwide retrospective cohort study

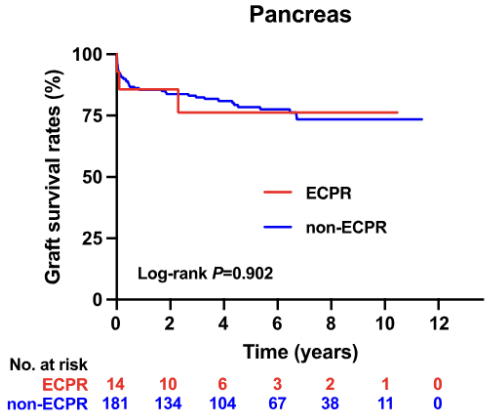
Tetsuya Yumoto[1*], Kohei Tsukahara[1], Takafumi Obara[1], Takashi Hongo[1], Tsuyoshi Nojima[1], Hiromichi Naito[1] and Atsunori Nakao[1]

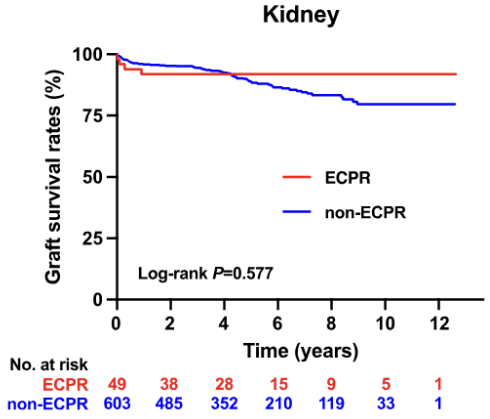
ECMO et don d'organes

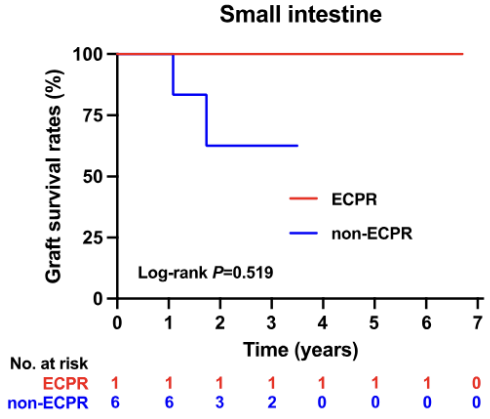


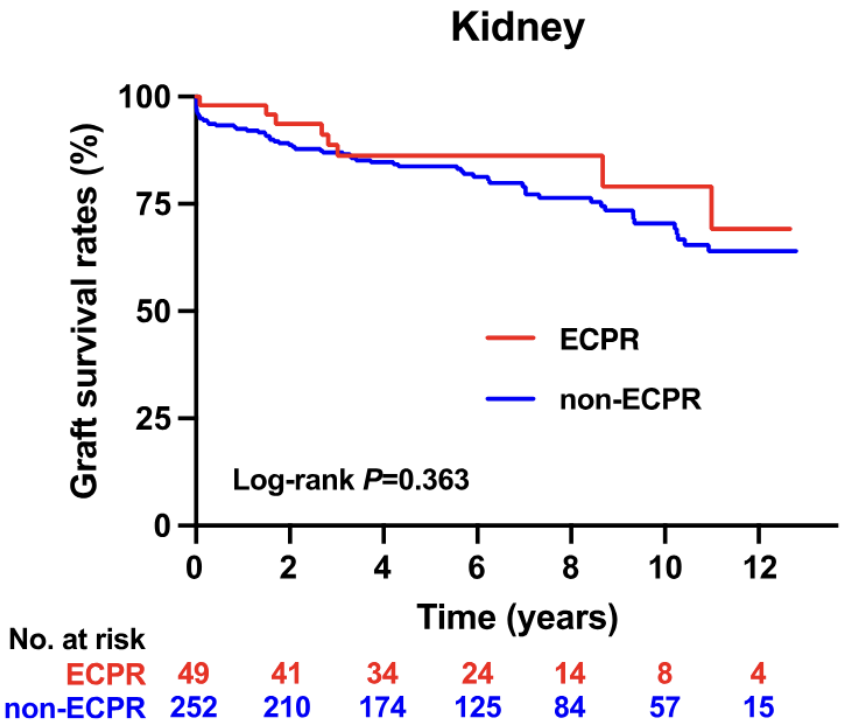




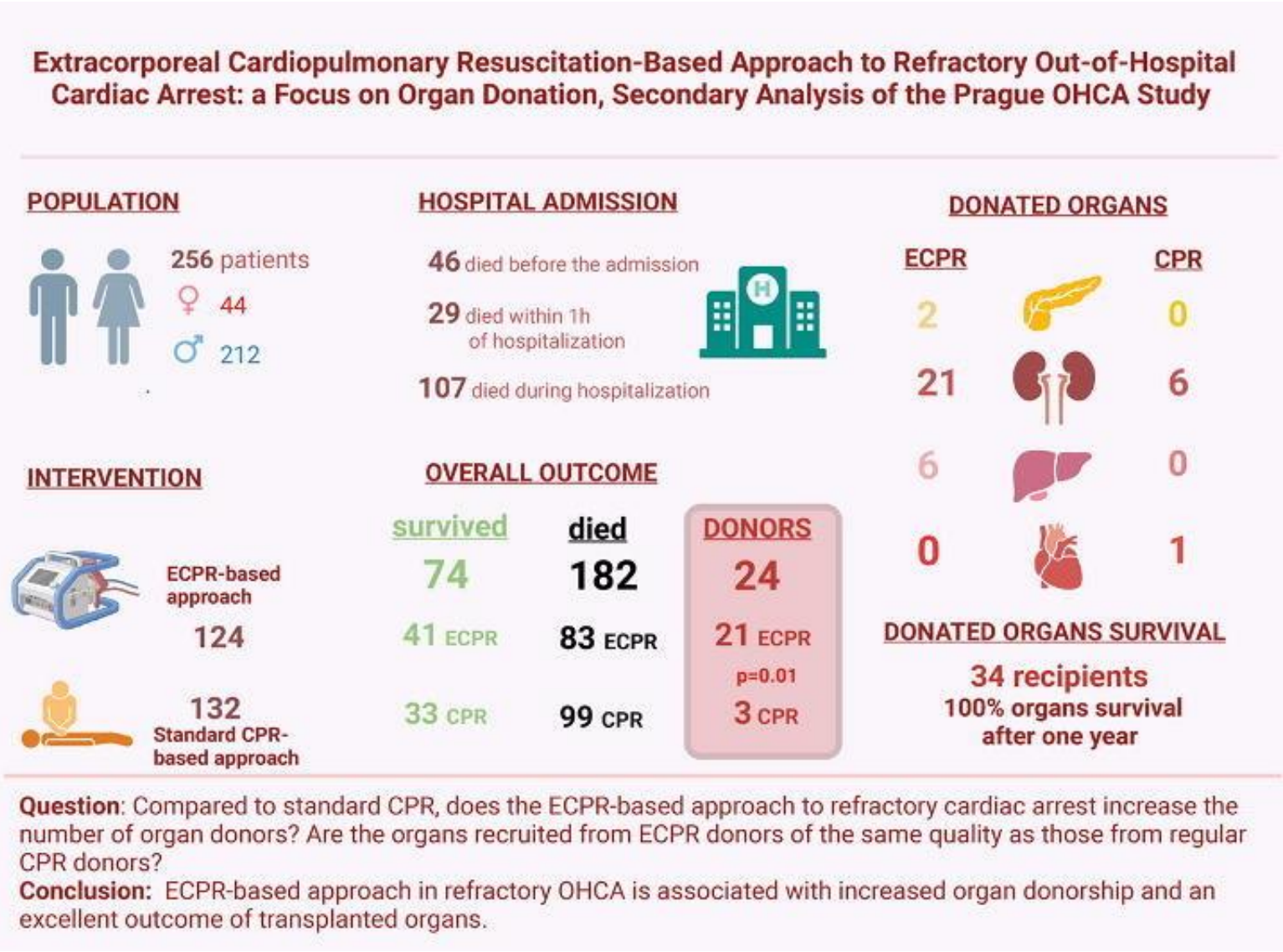








ECMO et don d'organes



RESUSCITATION 193 (2023) 109993

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Resuscitation

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

EUROPEAN RESUSCITATION COUNCIL

Clinical paper

Extracorporeal cardiopulmonary resuscitation-based approach to refractory out-of-hospital cardiac arrest: A focus on organ donation, a secondary analysis of a Prague OHCA randomized study

J. Smalcova[a,c], S. Havranek[a], E. Pokorna[b], O. Franek[c], M. Huptych[d], P. Kavalkova[a], J. Pudil[a], D. Rob[a], M. Dusik[a], J. Belohlavek[a,]*

ECMO et don d'organes

RESUSCITATION 203 (2024) 110391

Available online at ScienceDirect

Resuscitation

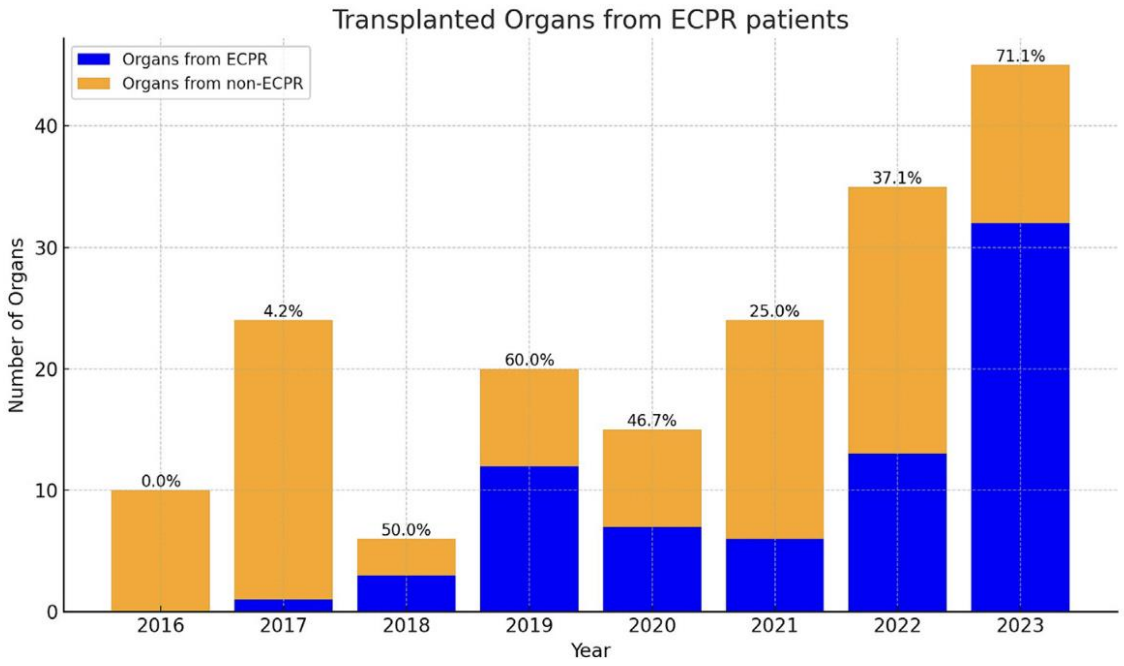
journal homepage: www.elsevier.com/locate/resuscitation

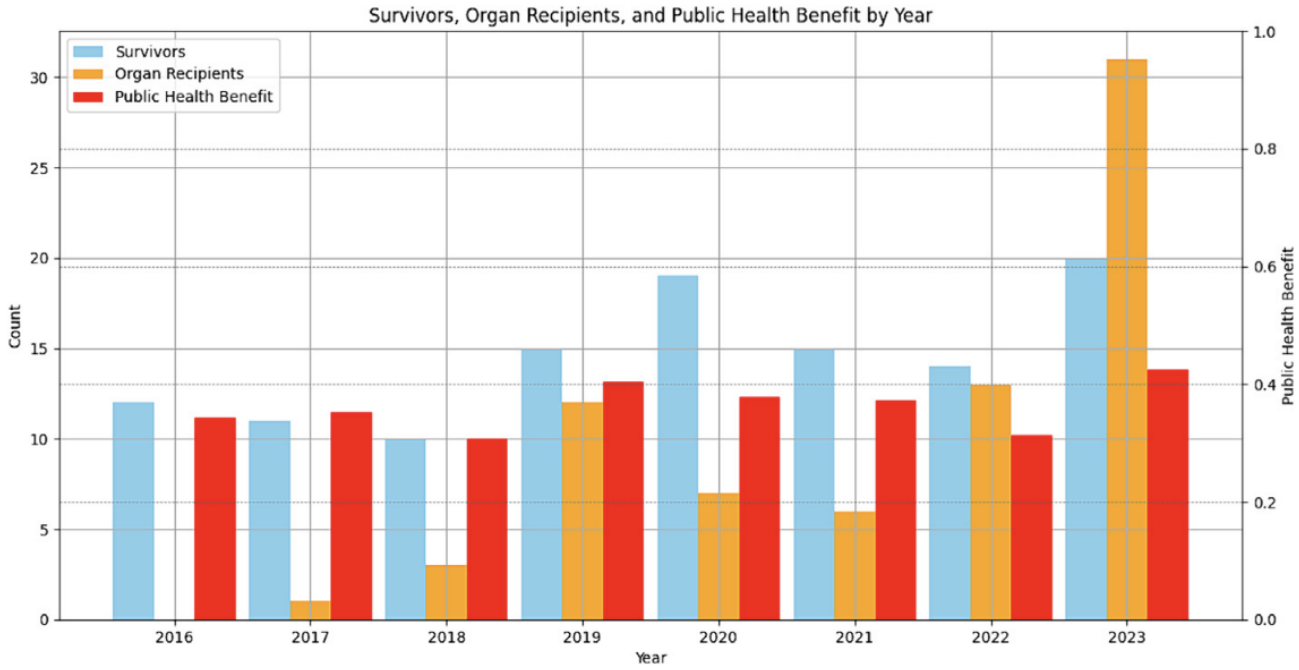
Short paper

Temporal trends in organ donation among cardiac arrest patients treated with extracorporeal cardiopulmonary resuscitation

Despoina Koukousaki[a], Marinos Kosmopoulos[a], John Mallow[a], Pierre S. Sebastian[b], Christopher Monti[c], Alejandra Gutierrez[a], Andrea Elliott[a], Rajat Kalra[a], Sergey Gurevich[a], Tamas Alexy[a], Charles Bruen[d], Varvara Kirchner[e], Jason A. Bartos[a], Demetris Yannopoulos[a,]*

ECMO et don d’organes





REBOA

Principe

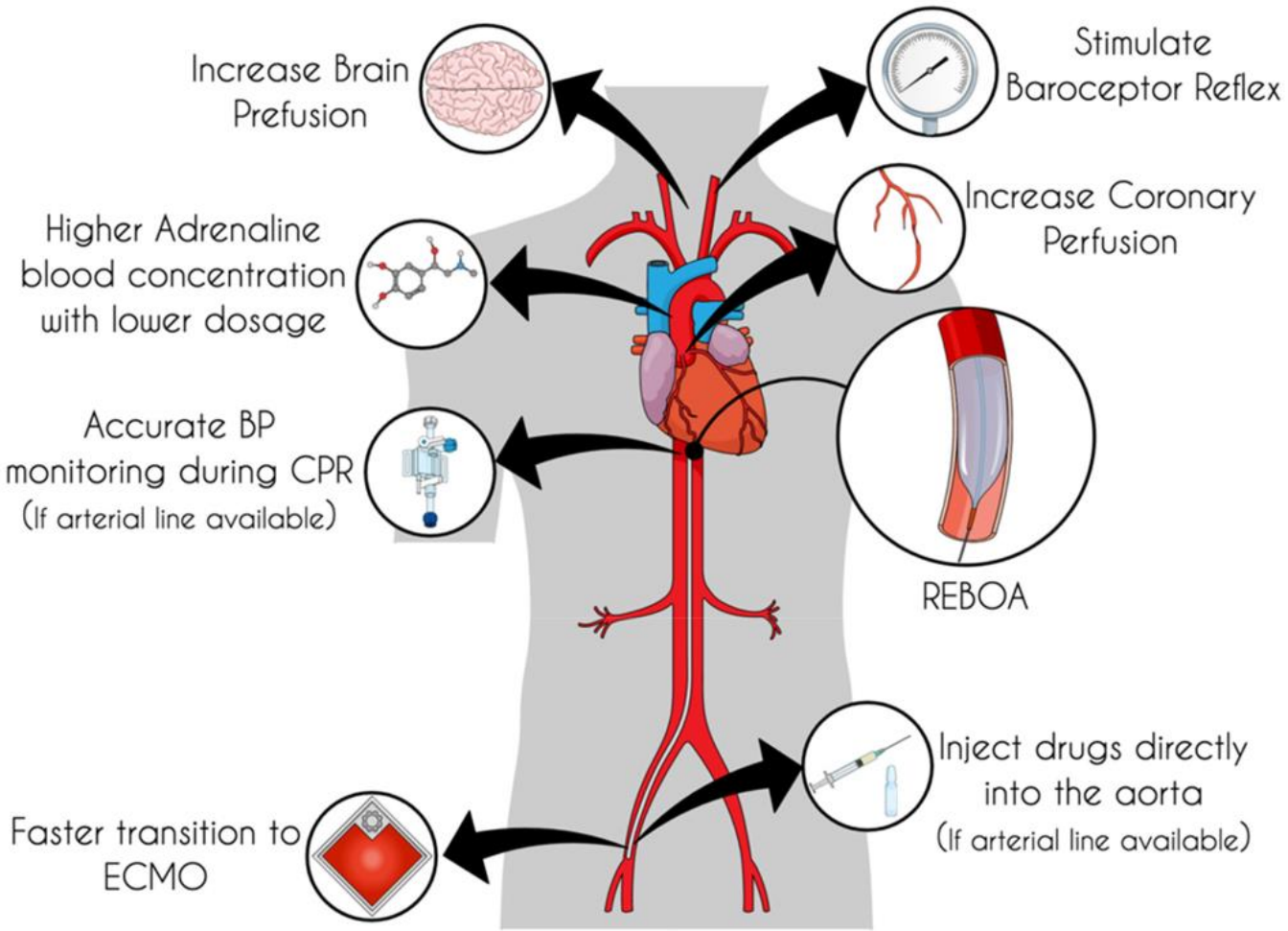
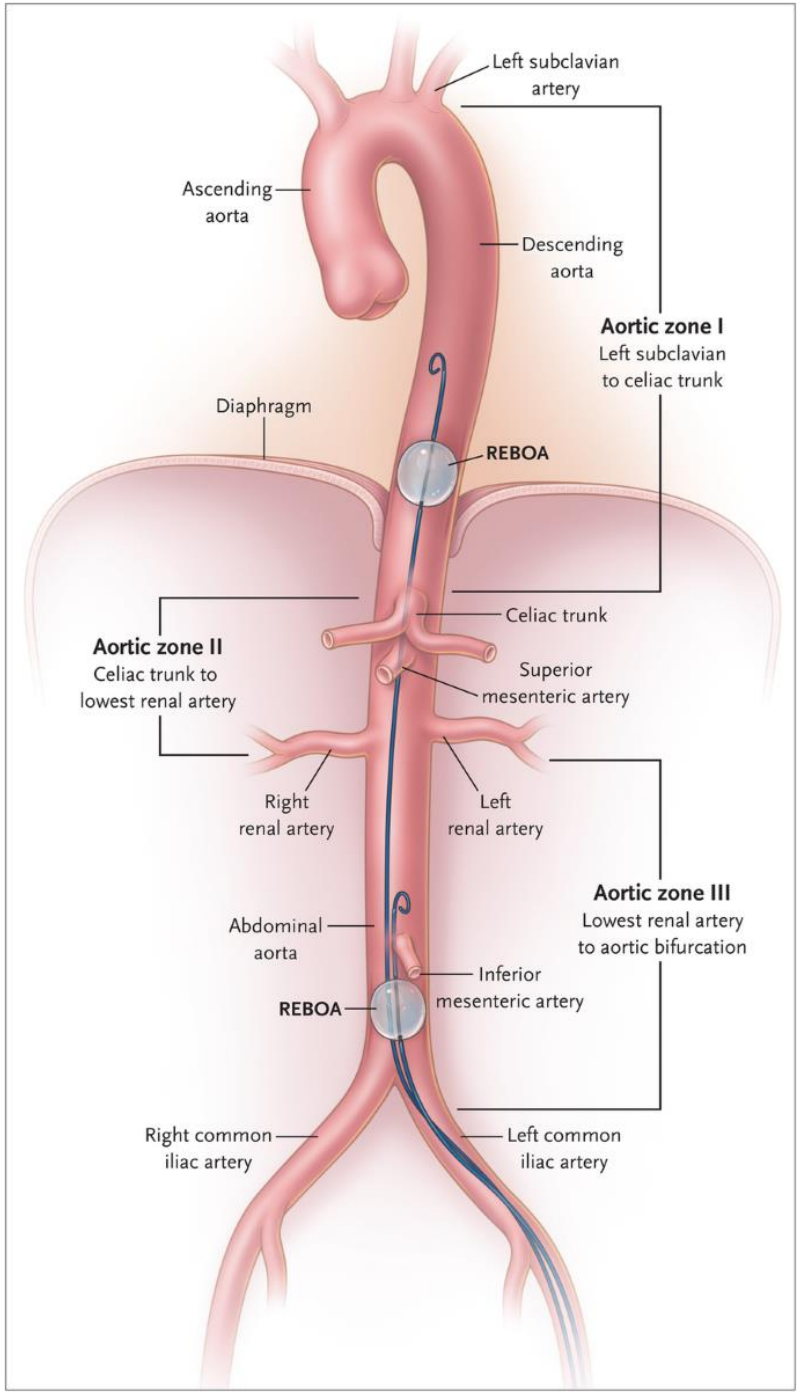


Figure 1. Potential physiological effects of REBOA during NTCA and the advantages of having the catheter placed into the aorta. REBOA: Resuscitative Endovascular Balloon Occlusion of the Aorta, NTCA: Non-Traumatic Cardiac Arrest, ECMO: Extracorporeal Membrane Oxygenation.



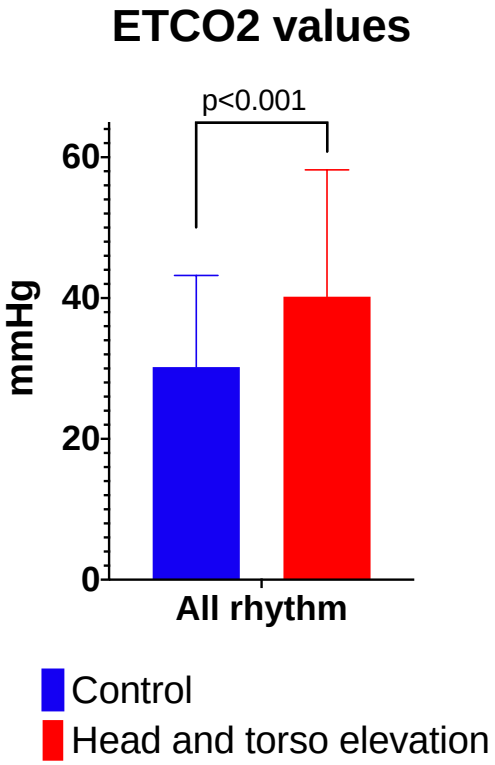
Principe

Effet de la décompression active + valve d'impédance (pression négative intrathoracique)

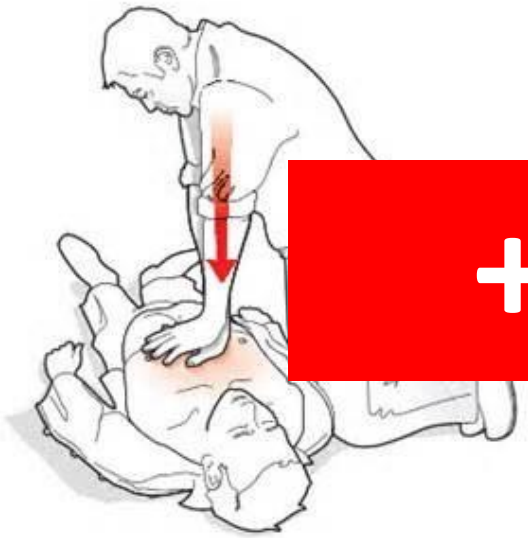
+ Surélévation tête et tronc (retour veineux)

GRAVITY Study

122 patients included



59 patients



63 patients

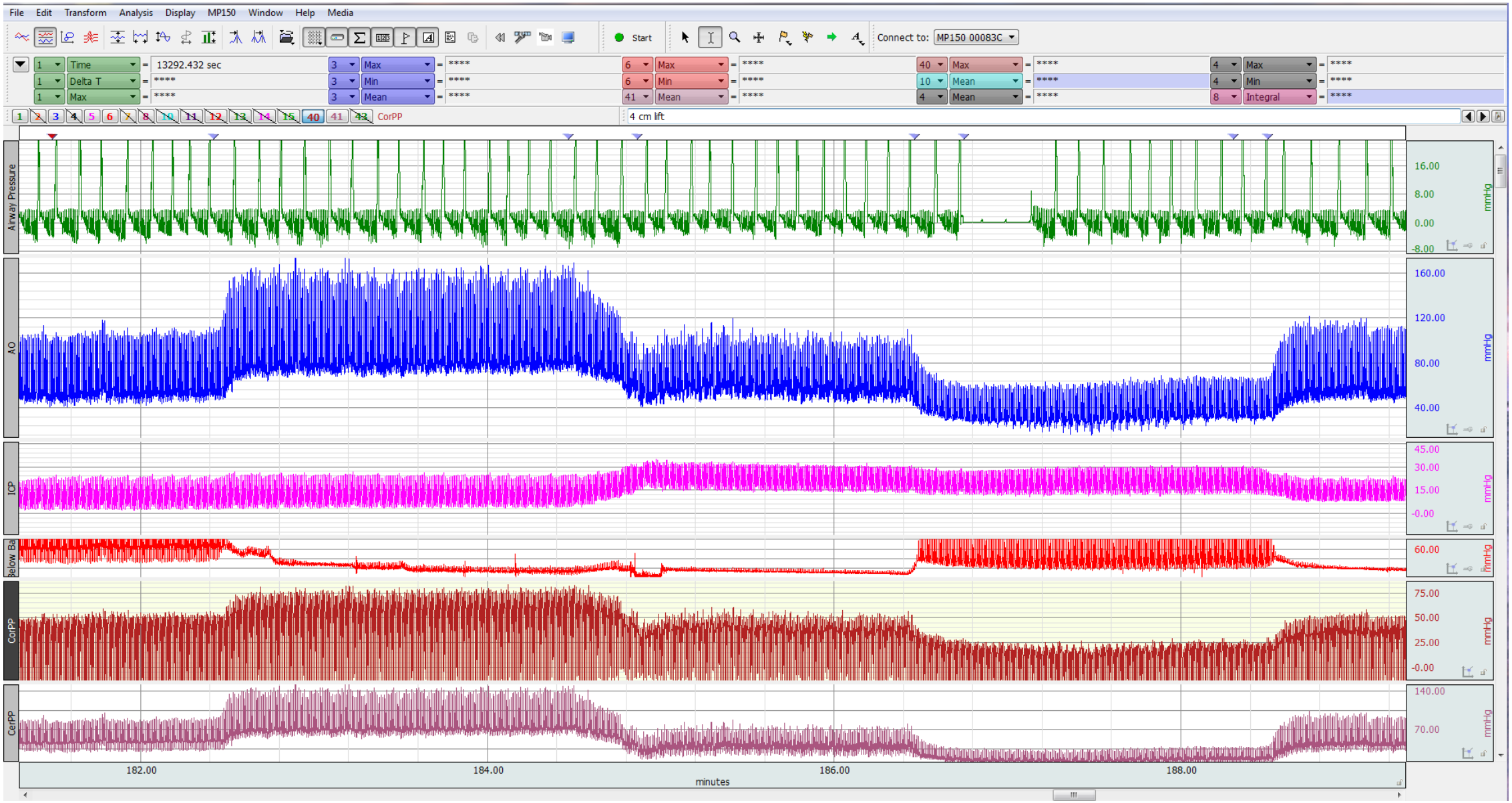
+ 36%

30 ± 13 mmHg

41 ± 18 mmHg

p<0.001

Principe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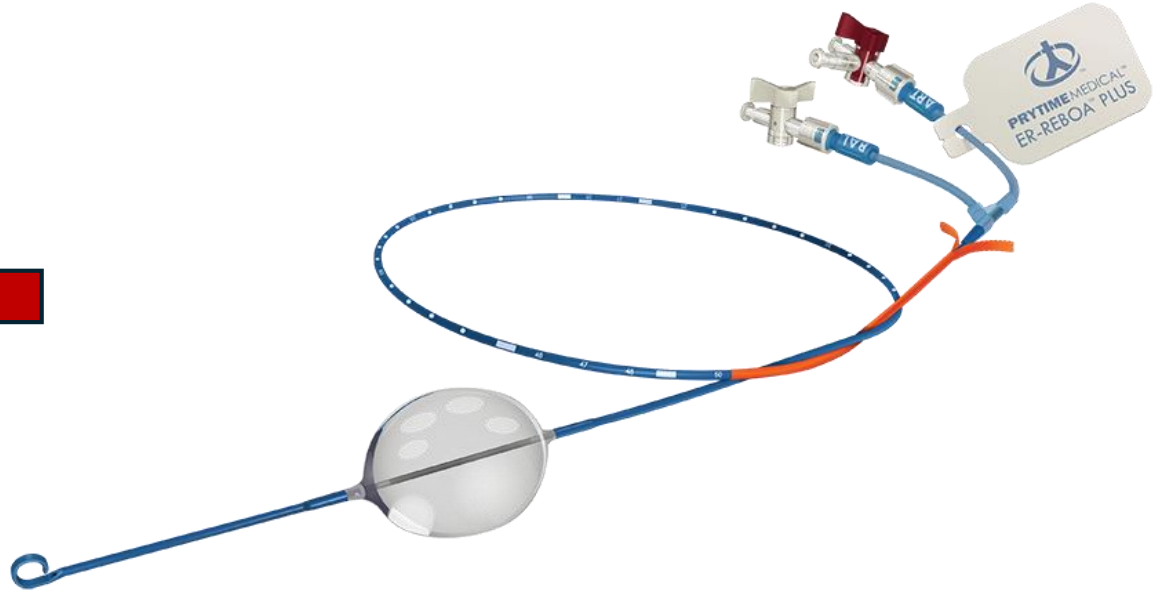
0.00
-8.00
160.00
120.00
80.00
40.00
45.00
30.00
15.00
-0.00
60.00
75.00
50.00
25.00
140.00
70.00
mmHg
182.00
184.00
186.00
188.00
minutes

GRAVITY 2 Study

+



Critères d'inclusion

- ≥ 18 ans
- No-flow < 10 minutes
- $EtCO_2$ ≥ 20 mmHg à l'arrivée de la REBOA Team
- Patient dans l'aire Métropolitaine de Grenoble
- Patient affilié à la sécurité sociale

Critères de non inclusion

Critères ECMO :

- < 65 ans
- Low-flow < 5 minutes
- Rythme choquable
- Signes de vie per-réa

- **RACS** avant la pose de REBOA
- Patient éligible à **l'ECMO**
- Patiente **enceinte** de façon évidente
- ACR **traumatique**
- Patient non compatible avec **LUCAS** (hauteur du sternum de 170 à 303 mm ou largeur maximale du thorax de 449 mm), pas de critère de poids
- **RCP non justifiée** (mort inéluctable, maladie terminale irréversible, durée trop longue de l'arrêt cardiaque, directives personnelles anticipées de non réanimation)
- Patients privés de libertés, sous tutelle ou curatelle (connu à l'inclusion)
- Patient non compatible avec un accès vasculaire fémoral 8 Fr

Chez l'homme ?

Study	Nb Patients	ROSC	Survival	Protocol post-ROSC
Jang et al. Resuscitation, 2022	15	6 (40%)	1	Deflating REBOA Slowly
Daley, James et al. Journal of the American College of Emergency Physicians open, 2022	5	4 (80%)	0	MAP > 60 mmHg, 1 mL by 1 mL, if < 60 mmHg : stop deflation Limit REBOA exposure: 15 minutes (complete deflation)
Gamberini et al. Resuscitation, 2021	18	5 (27%)	0	Gradual deflation aiming at a MAP of 60 mmHg
Bred et al. JAHA, 2019	10	6 (60%)	1	Aortic balloon was deflated slowly.
Brant-Zawadzki et al. Resus Plus, 2024	8	3 (37.5%)	0	Balloon gradually deflated over one minute.

REBOA + don d'organe ?

Potentiel effet sur le rein (dépendant durée de gonflage)

Aucune donnée actuellement

Synthèse

Arrêt cardiaque et don d’organe

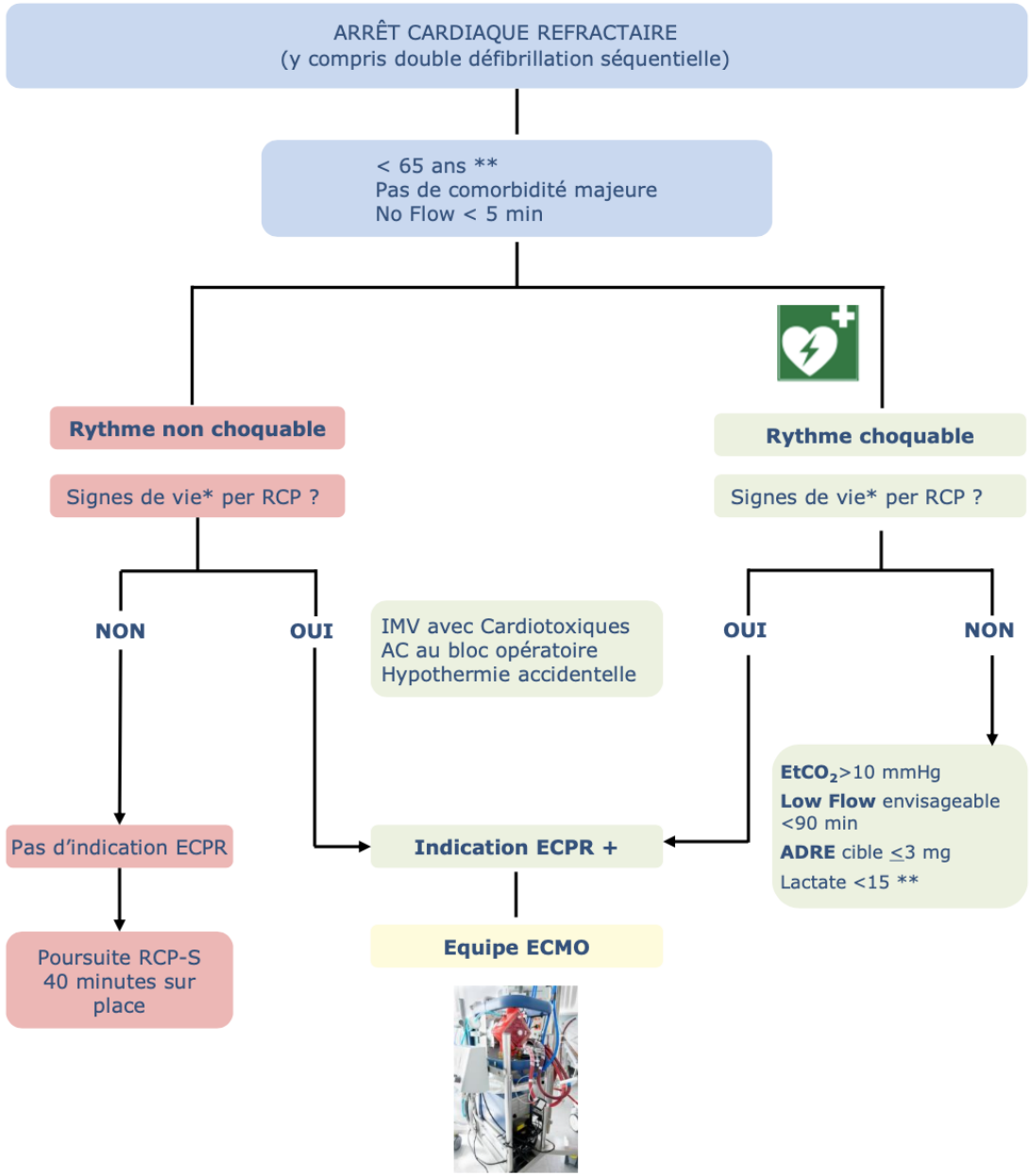
ECMO

DDAC M2

M3

REBOA

Arrêt cardiaque et don d'organe



Si patient non éligible à ECPR et échec RCP-S => PENSER DDAC (départements 74-73-01-38) :

Age <55ans
+ absence de contre-indication: HTA traité, diabète traité, cancer .....
+ No Flow <15 min
+ Arrivée CH <120 min de l'effondrement
(<90 min si pas de planche à masser)

Critères importants :

- **Âge** : ECMO 65 ans ; DDAC 55 ans
- **No-flow** : ECMO 5 min ; DDAC 15 min
- **Arrivée CH** : ECMO 90 min ; DDAC 120 min
- **Aucun ATCD pour le DDAC**

Conclusion

Nouvelles thérapeutiques prometteuses pour la prise en charge des ACR

Compatibles avec le don d'organe, pouvant même apporter plus de patients éligibles

A suivre pour les années futures