

難治性VT/VFに対するECPRは 従来のCPRと差がない！？ INCEPTION試験

大阪医科薬科大学病院 救急医学教室 近藤 あゆか

The NEW ENGLAND
JOURNAL *of* MEDICINE

ESTABLISHED IN 1812

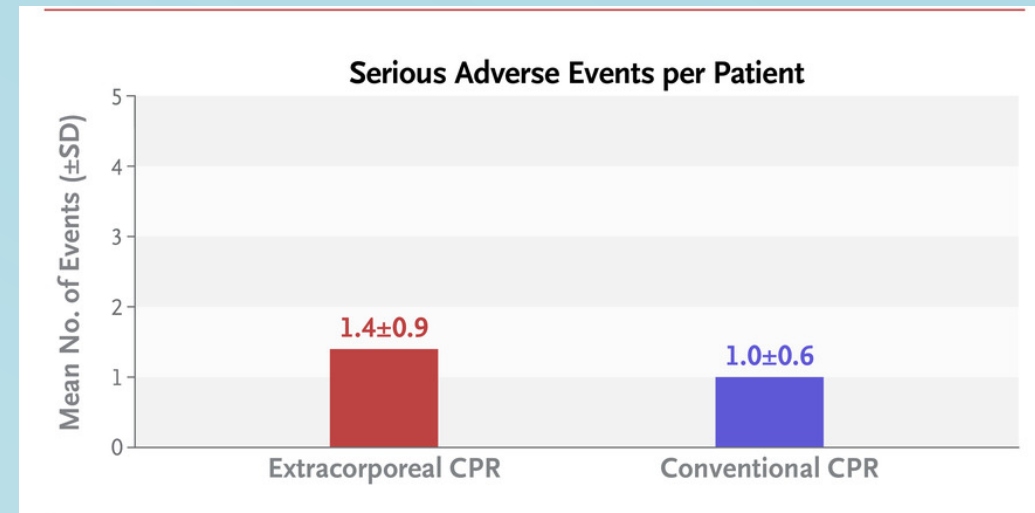
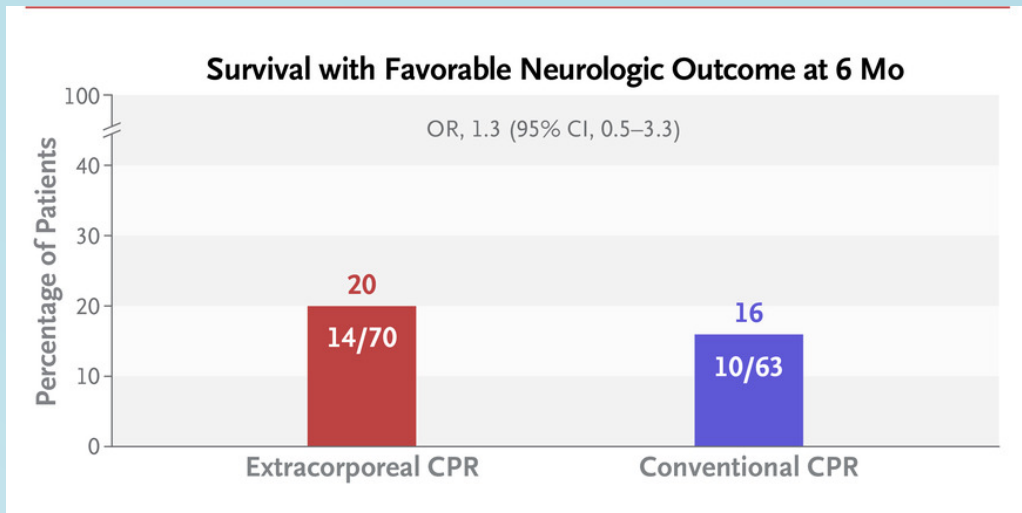
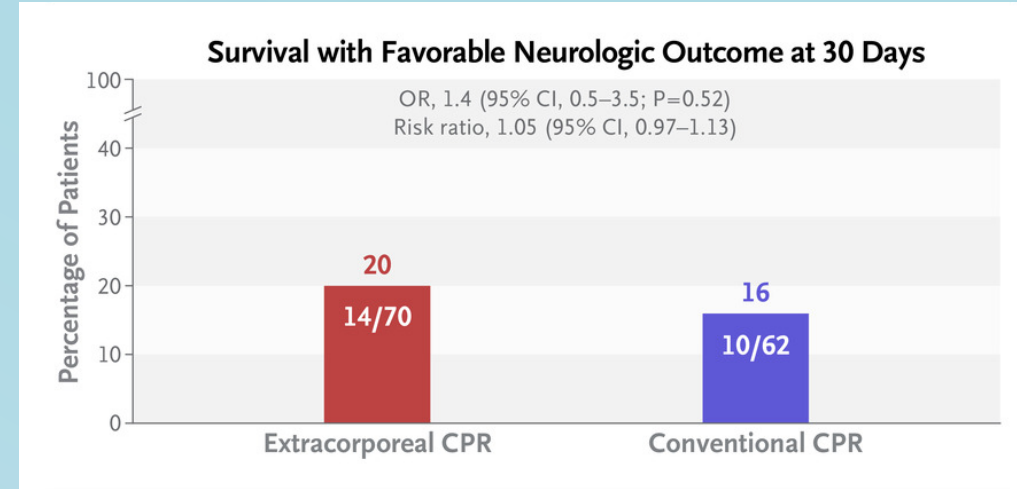
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VOL. 388 NO. 4

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

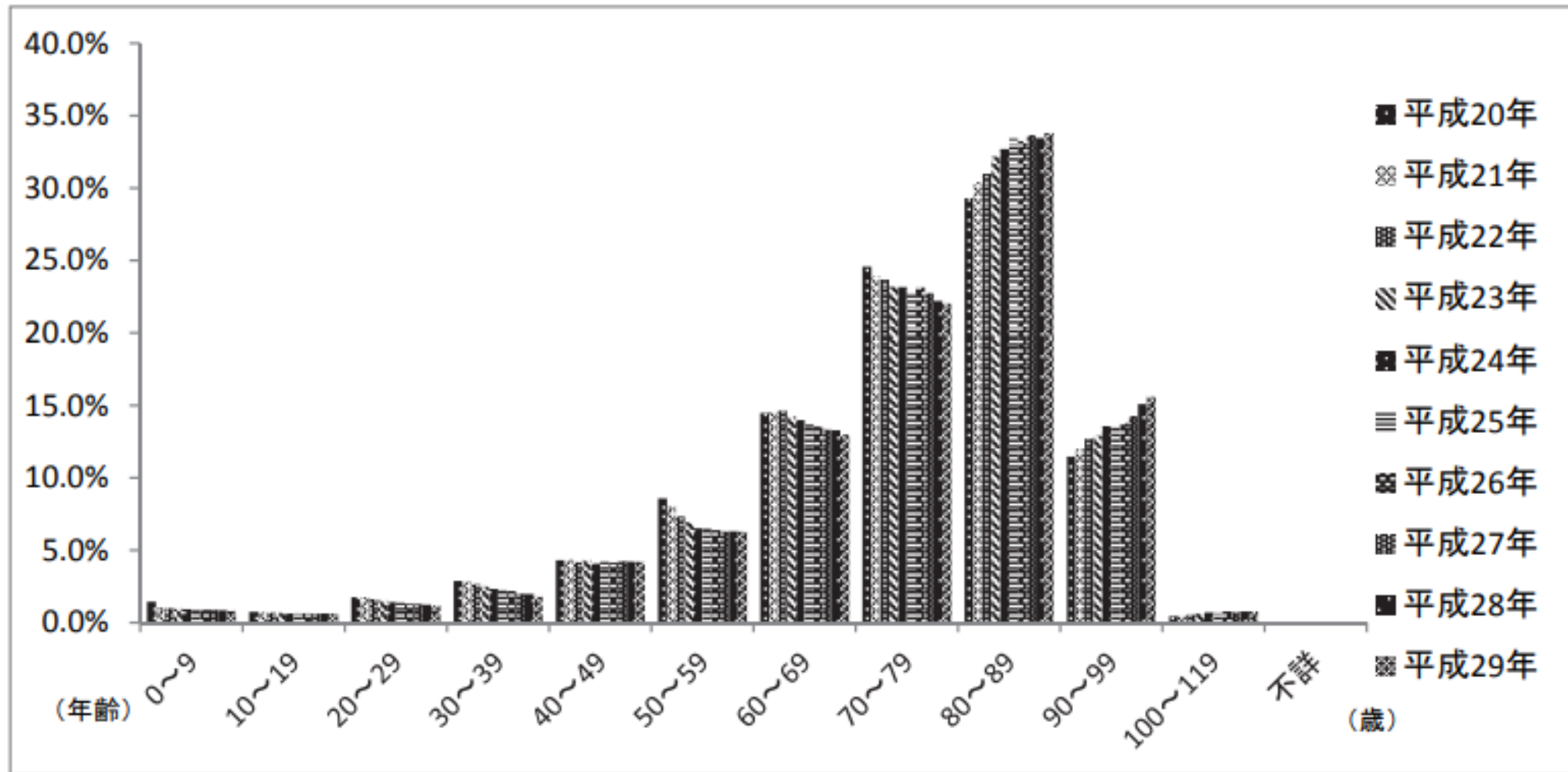
M.M. Suverein, T.S.R. Delnoij, R. Lorusso, G.J. Brandon Bravo Bruinsma, L. Otterspoor, C.V. Elzo Kraemer, A.P.J. Vlaar, J.J. van der Heijden, E. Scholten, C. den Uil, T. Jansen, B. van den Bogaard, M. Kuijpers, K.Y. Lam, J.M. Montero Cabezas, A.H.G. Driessen, S.Z.H. Rittersma, B.G. Heijnen, D. Dos Reis 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

結論：ショック適応の難治性院外心停止患者に対して、早期ECMO導入は30日の良好な神経学的転帰および生存を改善しない



院外心停止患者の年齢

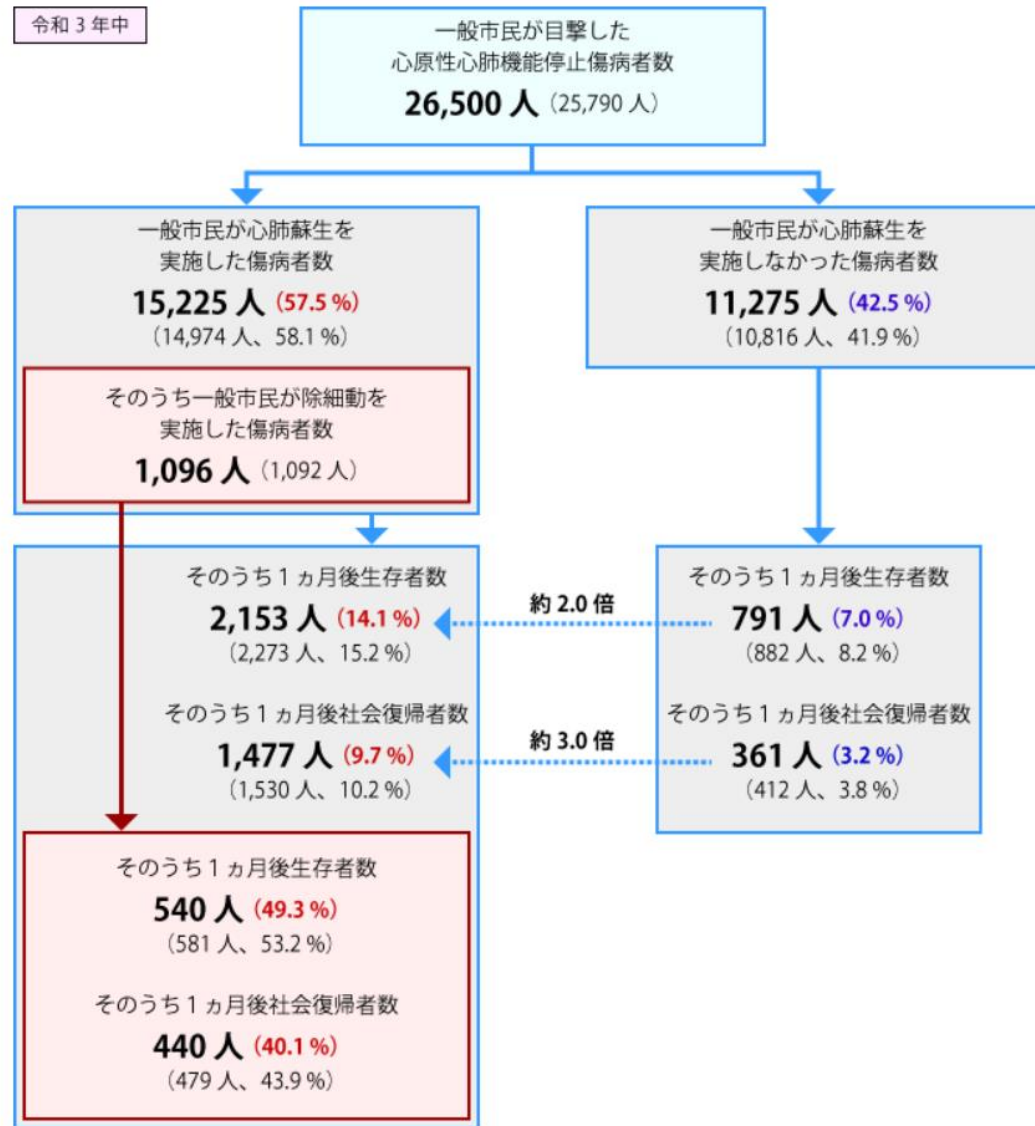
第78図 心肺機能停止傷病者の年齢区分毎の割合（10ヵ年集計）



院外心停止(OHCA)の生存率

緩やかに改善しているものの未だに**7-14%**

● 一般市民が目撃した心原性心肺機能停止傷病者のうち、一般市民による心肺蘇生等実施の有無別の生存率・社会復帰率（令和3年）



生存率および脳神経学的予後向上のためにわかっていること

OHCA



院外心停止時の状況による生存率の違い



	Surviving to one month	Surviving to one month with VF	Surviving to one month with non-VF	OR	CI (95%)	P
All patients	5.0% (n=10773)	9.5% (n=4686)	1.6% (n=6087)	6.4	5.1-8.0	< 0.001
Non-witnessed	1.7% (n=3257)	4.0% (n=996)	0.6% (n=2261)	6.7	3.6-12.4	< 0.001
Bystander-witnessed	6.1% (n=5453)	9.6% (n=2939)	2.0% (n=2514)	5.1	3.8-7.0	< 0.001
Crew-witnessed	12.7% (n=997)	31.9% (n=320)	3.7% (n=677)	12.2	7.7-19.4	< 0.001

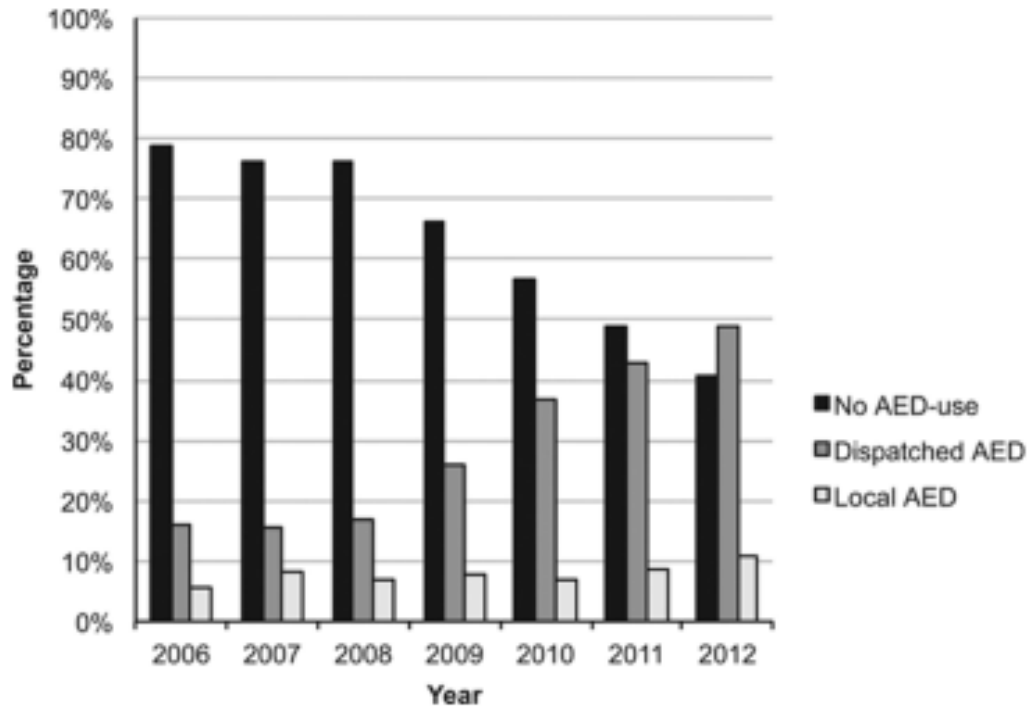
AEDの重要性



Improved Survival After Out-of-Hospital Cardiac Arrest and Use of Automated External Defibrillators

Marieke T. Blom, Stefanie G. Beesems, Petronella C.M. Homma, Jolande A. Zijlstra, Michiel Hulleman, Daniel A. van Hoeijen, Abdennasser Bardai, Jan G.P. Tijssen, Hanno L. Tan and Rudolph W. Koster

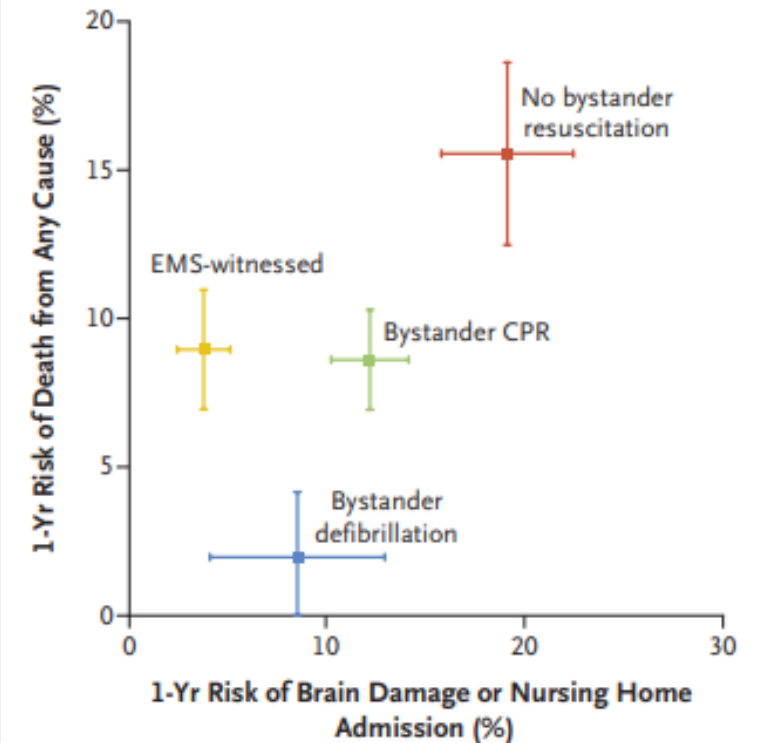
Originally published 15 Nov 2014 | <https://doi.org/10.1161/CIRCULATIONAHA.114.010905> | Circulation. 2014;130:1868–1875



ORIGINAL ARTICLE

Bystander Efforts and 1-Year Outcomes in Out-of-Hospital Cardiac Arrest

Kristian Kragholm, M.D., Ph.D., Mads Wissenberg, M.D., Ph.D., Rikke N. Mortensen, M.Sc., Steen M. Hansen, M.D., Carolina Malta Hansen, M.D., Ph.D., Kristinn Thorsteinsson, M.D., Ph.D., Shahzleen Rajan, M.D., Freddy Lippert, M.D., Fredrik Folke, M.D., Ph.D., Gunnar Gislason, M.D., Ph.D., Lars Køber, M.D., D.Sc., Kirsten Fonager, M.D., Ph.D., Svend E. Jensen, M.D., Ph.D., Thomas A. Gerds, Ph.D., Christian Torp-Pedersen, M.D., D.Sc., and Bodil S. Rasmussen, M.D., Ph.D.



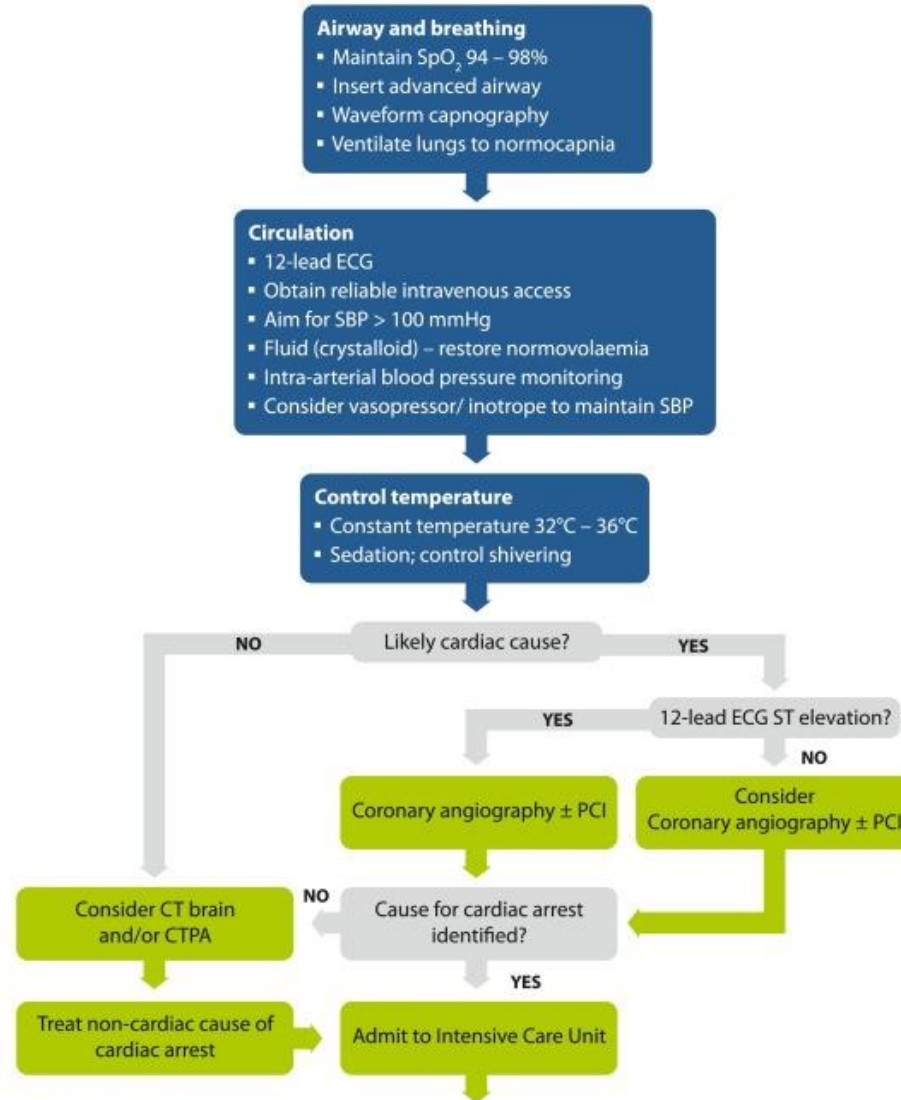
心拍再開後の治療のエビデンス



Return of spontaneous circulation and comatose

Immediate treatment

Diagnosis



Optimising recovery

- ICU management**
- Temperature control: constant temperature 32°C – 36°C for ≥ 24h; prevent fever for at least 72 h
 - Maintain normoxia and normocapnia; protective ventilation
 - Optimise haemodynamics (MAP, lactate, ScvO₂, CO/CI, urine output)
 - Echocardiography
 - Maintain normoglycaemia
 - Diagnose/treat seizures (EEG, sedation, anticonvulsants)
 - Delay prognostication for at least 72 h

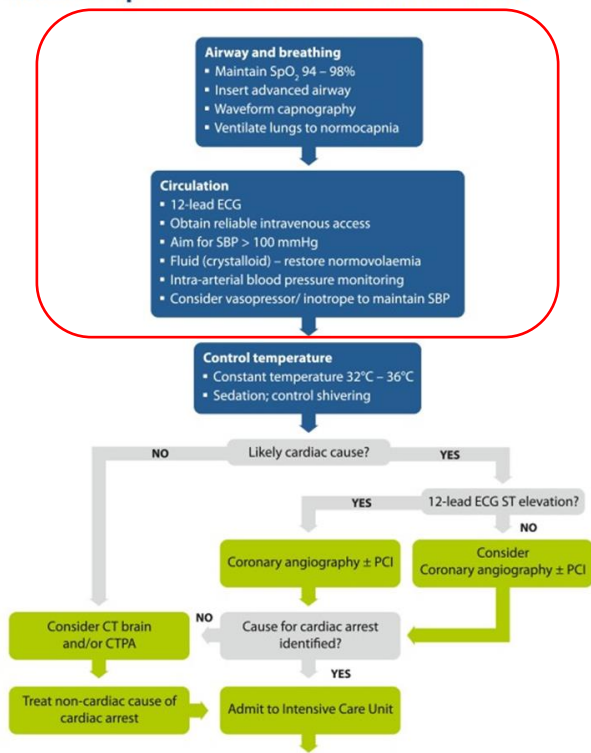
Secondary prevention
e.g. ICD, screen for inherited disorders, risk factor management

Follow-up and rehabilitation

Return of spontaneous circulation and comatose

Immediate treatment

Diagnosis

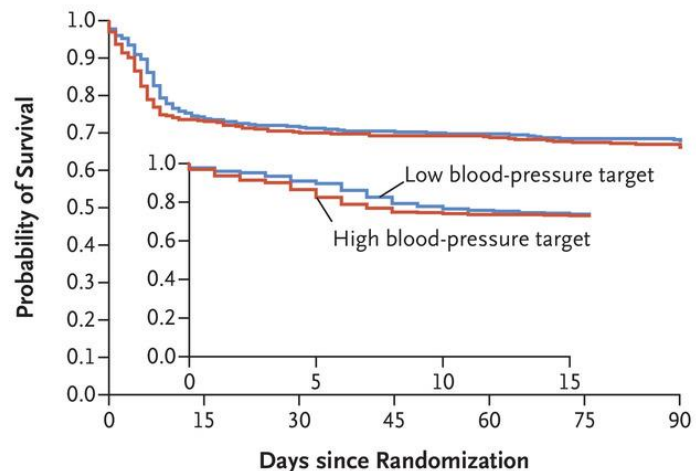


ORIGINAL ARTICLE

Blood-Pressure Targets in Comatose Survivors of Cardiac Arrest

J. Kjaergaard, J.E. Møller, H. Schmidt, J. Grand, S. Mølstrøm, B. Borregaard, S. Venø, L. Sarkisian, D. Mamaev, L.O. Jensen, B. Nyholm, D.E. Høfsten, J. Josiassen, J.H. Thomsen, J.J. Thune, L.E.R. Obling, M.G. Lindholm, M. Frydland, M.A.S. Meyer, M. Winther-Jensen, R.P. Beske, R. Frikke-Schmidt, S. Wiberg, S. Boesgaard, S.A. Madsen, V.L. Jørgensen, and C. Hassager

MAP > 65程度でよい



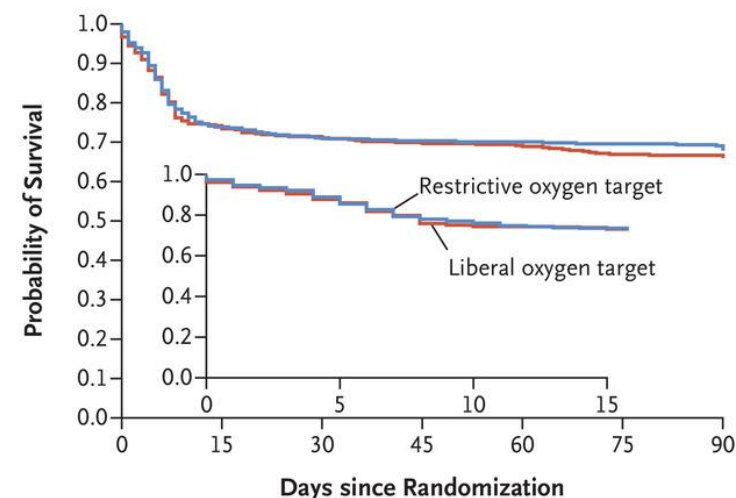
No. at Risk	0	15	30	45	60	75	90
Low blood-pressure target	396	294	284	279	276	271	270
High blood-pressure target	393	288	276	272	271	265	263

ORIGINAL ARTICLE

Oxygen Targets in Comatose Survivors of Cardiac Arrest

H. Schmidt, J. Kjaergaard, C. Hassager, S. Mølstrøm, J. Grand, B. Borregaard, L.E. Roelsgaard Obling, S. Venø, L. Sarkisian, D. Mamaev, L.O. Jensen, B. Nyholm, D.E. Høfsten, J. Josiassen, J.H. Thomsen, J.J. Thune, M.G. Lindholm, M.A. Stengaard Meyer, M. Winther-Jensen, M. Sørensen, M. Frydland, R.P. Beske, R. Frikke-Schmidt, S. Wiberg, S. Boesgaard, V. Lind Jørgensen, and J.E. Møller

PaO2 > 60程度でよい



No. at Risk	0	15	30	45	60	75	90
Restrictive target	394	290	279	276	275	273	271
Liberal target	395	292	281	275	272	263	262

高い血圧管理、高い酸素管理を行っても死亡率および脳神経学的予後は変わらない

Return of spontaneous circulation and comatose

Immediate treatment

Airway and breathing

- Maintain SpO₂ 94 – 98%
- Insert advanced airway
- Waveform capnography
- Ventilate lungs to normocapnia

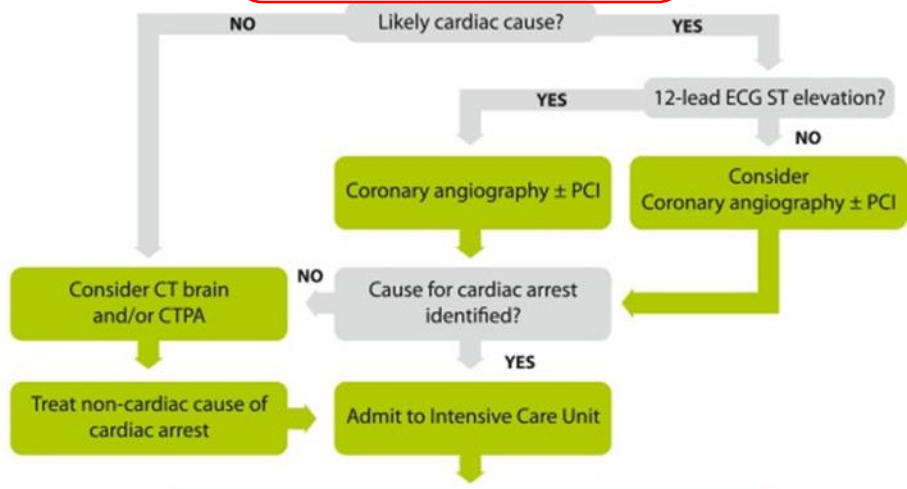
Circulation

- 12-lead ECG
- Obtain reliable intravenous access
- Aim for SBP > 100 mmHg
- Fluid (crystalloid) – restore normovolaemia
- Intra-arterial blood pressure monitoring
- Consider vasopressor/ inotrope to maintain SBP

Control temperature

- Constant temperature 32°C – 36°C
- Sedation; control shivering

Diagnosis



ORIGINAL ARTICLE

Hypothermia versus Normothermia after Out-of-Hospital Cardiac Arrest

J. Dankiewicz, T. Cronberg, G. Lilja, J.C. Jakobsen, H. Levin, S. Ullén, C. Rylander, M.P. Wise, M. Oddo, A. Cariou, J. Bělohávek, J. Hovdenes, M. Saxena, H. Kirkegaard, P.J. Young, P. Pelosi, C. Storm, F.S. Taccone, M. Joannidis, C. Callaway, G.M. Eastwood, M.P.G. Morgan, P. Nordberg, D. Erlinge, A.D. Nichol, M.S. Chew, J. Hollenberg, M. Thomas, J. Bewley, K. Sweet, A.M. Grejs, S. Christensen, M. Haenggi, A. Levis, A. Lundin, J. Düring, S. Schmidbauer, T.R. Keeble, G.V. Karamasis, C. Schrag, E. Faessler, O. Smid, M. Otáhal, M. Maggiorini, P.D. Wendel Garcia, P. Jaubert, J.M. Cole, M. Solar, O. Borgquist, C. Leithner, S. Abed-Maillard, L. Navarra, M. Annborn, J. Undén, I. Brunetti, A. Awad, P. McGuigan, R. Bjørkholm Olsen, T. Cassina, P. Vignon, H. Langeland, T. Lange, H. Friberg, and N. Nielsen, for the TTM2 Trial Investigators*

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Hypothermia vs. Normothermia after Out-of-Hospital Cardiac Arrest

OPEN-LABEL TRIAL WITH BLINDED OUTCOME ASSESSMENT

	Hypothermia (target body temperature, 33°C) N=925	Normothermia (target body temperature, ≤37.5°C) N=925
1850 Comatose adults after out-of-hospital cardiac arrest		
Death from any cause at 6 mo	50%	48%
	RR, 1.04; 95% CI, 0.94 to 1.14; P=0.37	
Modified Rankin scale score ≥4 at 6 mo	55%	55%
	RR, 1.00; 95% CI, 0.92 to 1.09	
Arrhythmia with hemodynamic compromise	24%	17%
Hypothermia did not lead to a lower 6-mo incidence of death than normothermia.		

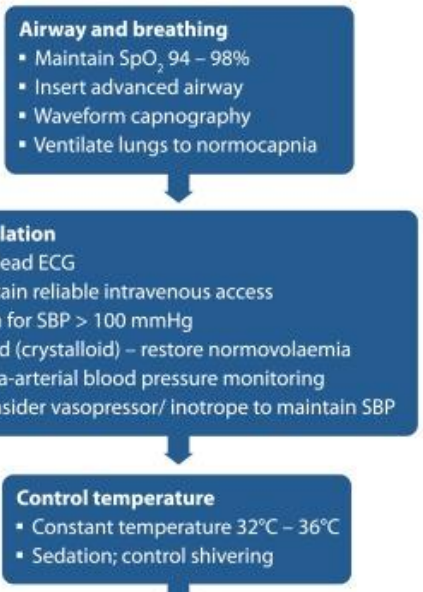
J. Dankiewicz et al. 10.1056/NEJMoa2100591

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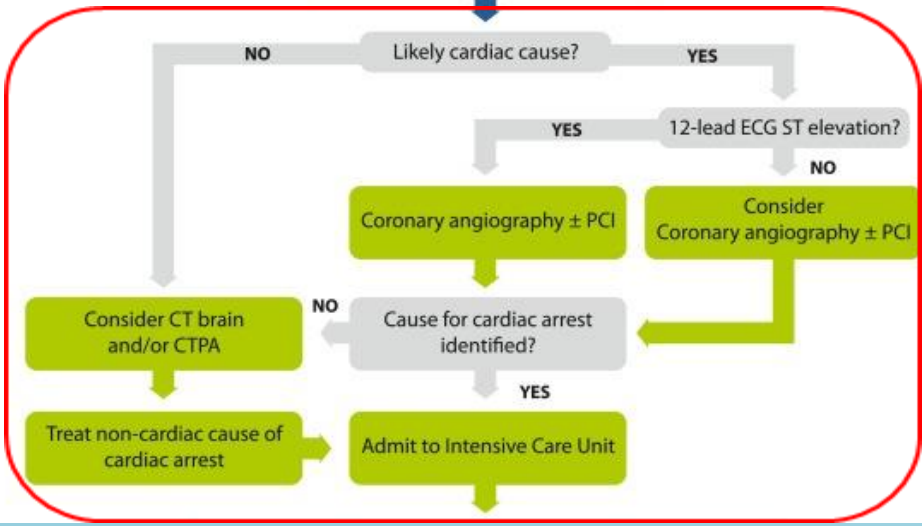
低体温療法は死亡率および脳神経学的予後を減らさない

Return of spontaneous circulation and comatose

Immediate treatment



Diagnosis



European Heart Journal (2020) 41, 4508–4517
 doi:10.1093/eurheartj/ehaa570

CLINICAL RESEARCH
 Arrhythmias

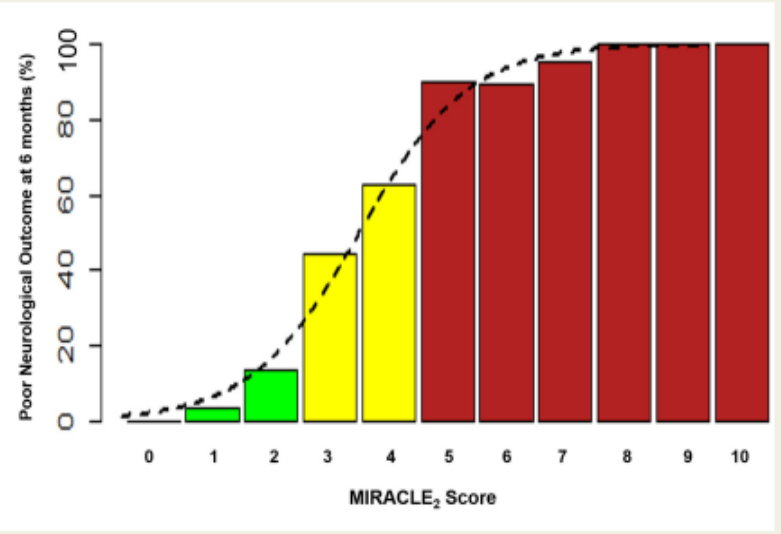
A practical risk score for early prediction of neurological outcome after out-of-hospital cardiac arrest: MIRACLE₂

Nilesh Pareek^{1,2*}, Peter Kordis³, Nicholas Beckley-Hoelscher⁴,
 Dominic Pimenta⁵, Spela Tadel Kocjancic³, Anja Jazbec³, Joanne Nevett⁶,
 Rachael Fothergill⁶, Sundeep Kalra⁵, Tim Lockie⁵, Ajay M Shah^{1,2},
 Jonathan Byrne^{1,2}, Marko Noc³, and Philip MacCarthy^{1,2}

Graphical Abstract

	Variable	Definition	Points
M	Missed	Unwitnessed Arrest	1
I	Initial Rhythm	Non-shockable Rhythm	1
R	Reactivity of Pupils	No Pupil Reactivity on ROSC	1
A	Age	0 - 60 years 60 - 80 years >80 years	0 1 3
C	Changing Rhythms	Any 2 of VF/PEA/Asystole	1
L	Low pH	pH <7.20	1
E₂	Epinephrine	Any Epinephrine Dose	2
MIRACLE₂ Score			10

Total Points: 0 1 2 3 4 5 6 7 8 9 10
 Risk of Poor Outcome: 0.025 0.05 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 0.95 0.99 0.999



STEMI or NSTEMI患者の脳神経学的予後評価

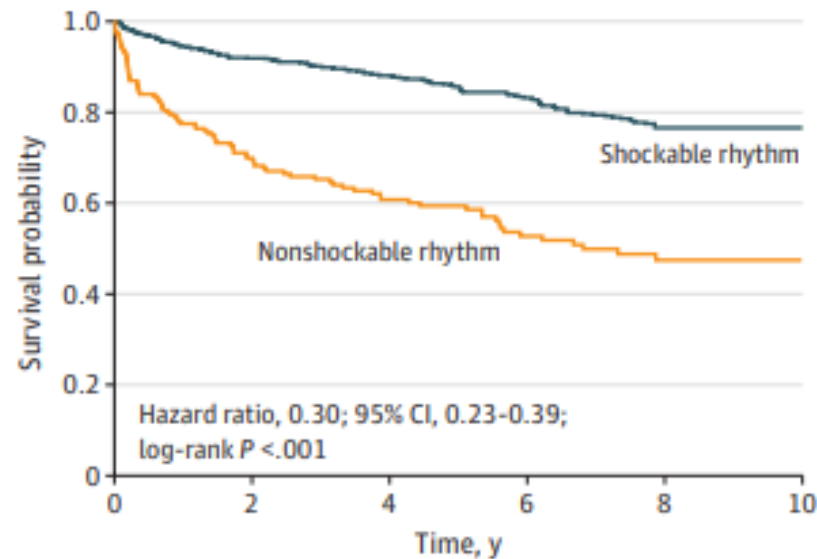


回復

JAMA Cardiology | Original Investigation

Long-term Survival After Out-of-Hospital Cardiac Arrest A Systematic Review and Meta-analysis

Figure 2. Kaplan-Meier Survival Curve for Patients Surviving to Hospital Discharge or 30 Days After Out-of-Hospital Cardiac Arrest Stratified by Initial Cardiac Arrest Rhythm



No. at risk (No. of deaths)

Shockable rhythm	911	(73)	776	(29)	602	(28)	393	(27)	36	(0)	15
Nonshockable rhythm	200	(59)	122	(15)	91	(10)	59	(5)	8	(0)	0

心原性院外心停止患者のうち生存退院した患者の10年生存率は約60%(約8000人の解析)

生存率および脳神経学的予後向上のためにわかっていること



どうやって心拍再開までもっていく？
ECMOでつなぐ？

前向き観察研究ではECPRの有効性が示されている

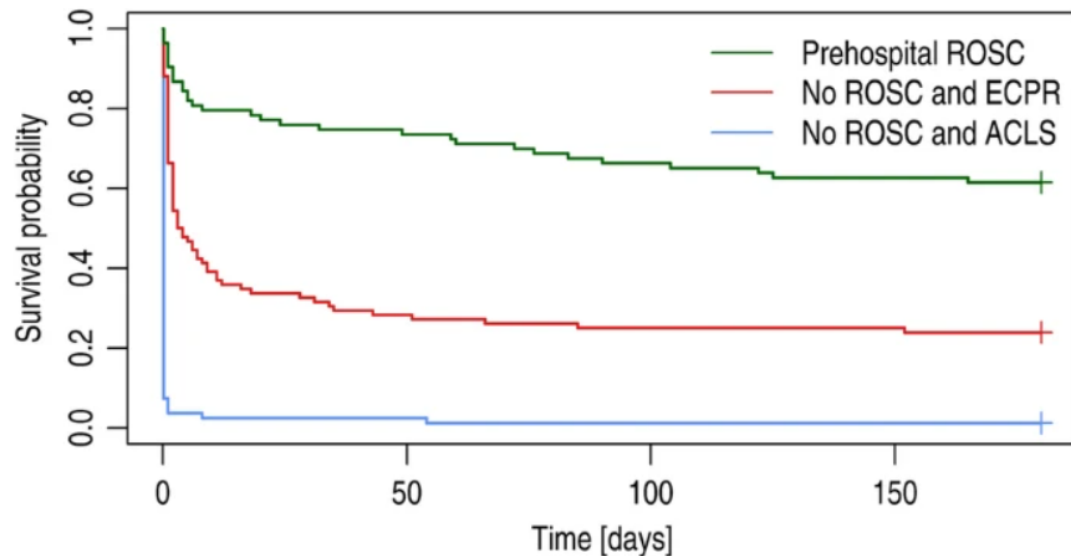
Extracorporeal versus conventional cardiopulmonary resuscitation for refractory out-of-hospital cardiac arrest: a secondary analysis of the Prague OHCA trial

Daniel Rob, Jana Smalcova, Ondrej Smid, Ales Kral, Tomas Kovarnik, David Zemanek, Petra Kavalkova, Michal Huptych, Arnost Komarek, Ondrej Franek, Stepan Havranek, Ales Linhart & Jan Belohlavek

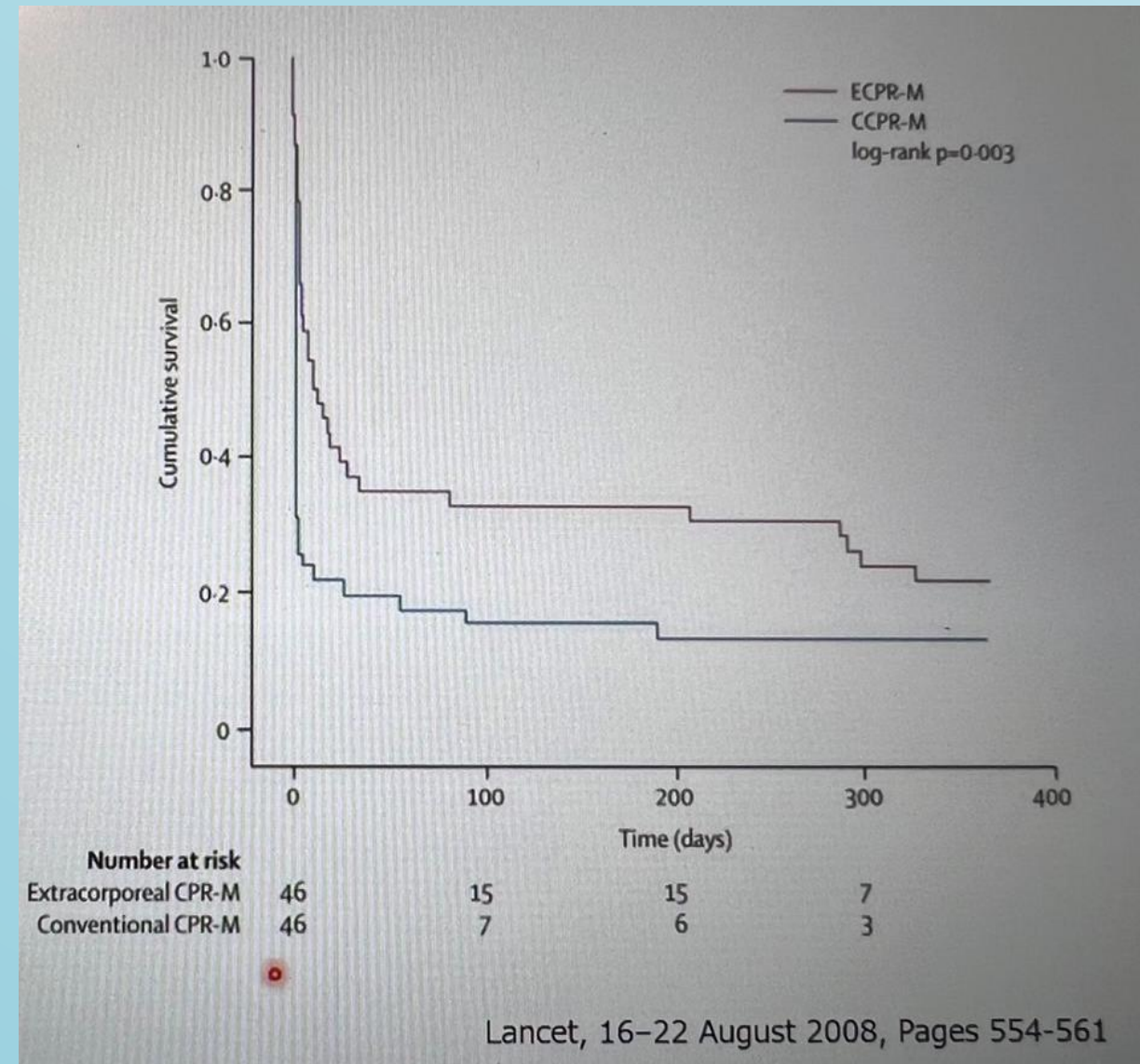
Critical Care 26, Article number: 330 (2022) | [Cite this article](#)

Fig. 2

Overall survival by ROSC & ECPR, P-value: <0.001



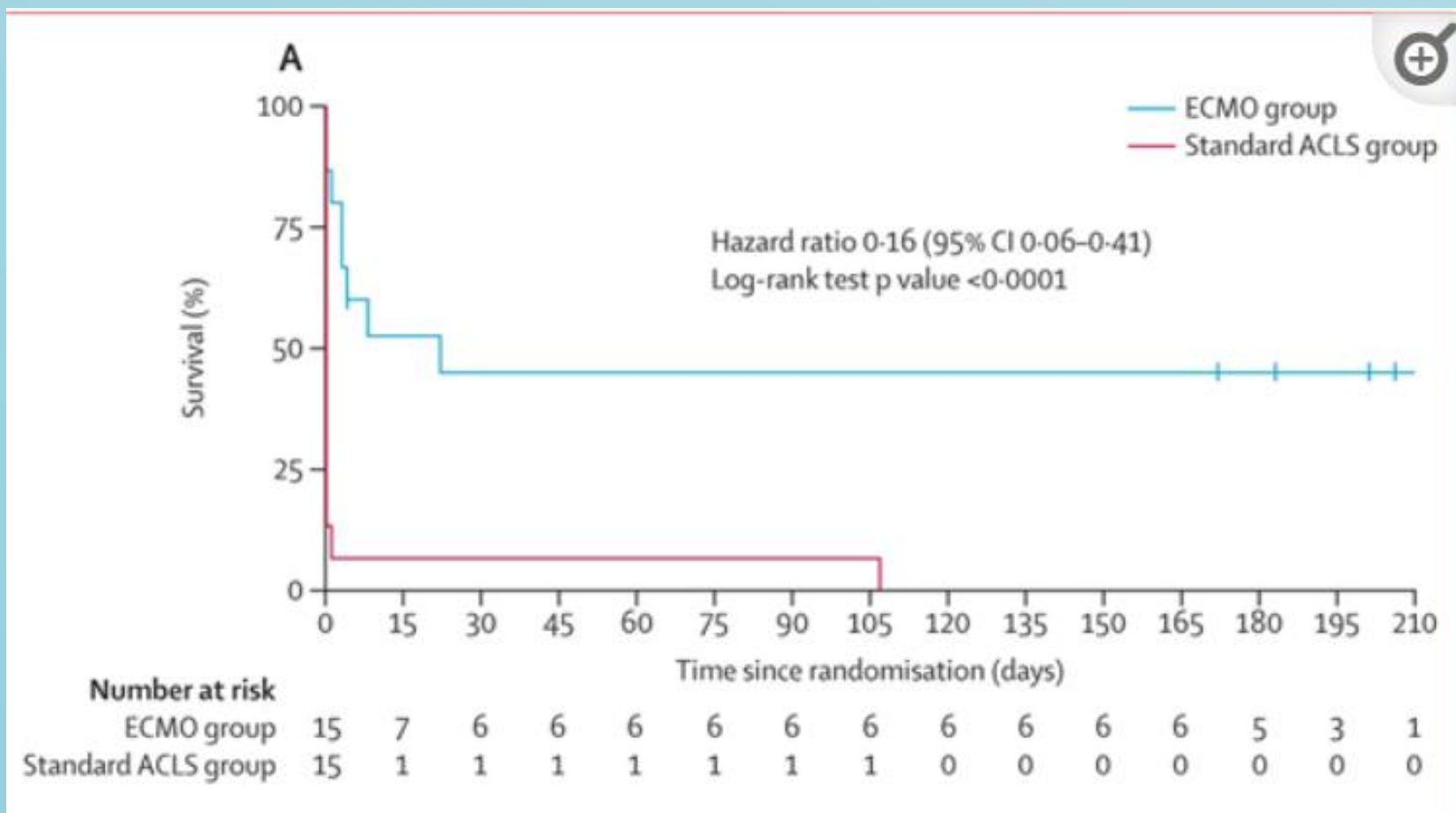
Kaplan-Meier survival curve in the study according to ROSC and ECPR status



ランダム化比較試験ではECPRの有効性は・・・

ARREST試験

単施設、ランダム化比較試験、VF/VTのOHCA、3回の除細動でもROSCなし



ランダム化比較試験ではECPRの有効性は・・・

単施設、ランダム化比較試験
心原性の院外心停止、5分以上のCPR

POPULATION

212 Men
44 Women



Adults with witnessed out-of-hospital cardiac arrest of presumed cardiac origin without return of spontaneous circulation

Median age: 58 years

LOCATIONS

Field;
1 Hospital cardiac center in Czech Republic



INTERVENTION



256 Patients analyzed

124

Invasive strategy

Intra-arrest transport to cardiac center for extracorporeal resuscitation and invasive assessment and treatment

132

Standard strategy

Continued advanced cardiac life support delivered on site

PRIMARY OUTCOME

Survival with good neurologic outcome (Cerebral Performance Category 1-2 on scale from 1 [conscious and alert] to 5 [brain death]) at 180 days after randomization

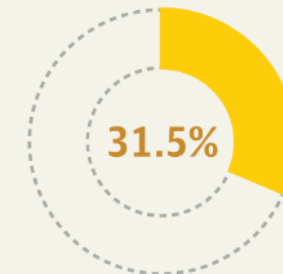
FINDINGS

© AMA

Survival to 180 days with good neurologic outcome

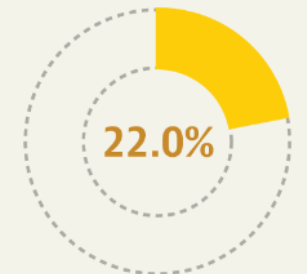
Invasive strategy

39 of 124 patients



Standard strategy

29 of 132 patients



The between-group difference was not significant:

9.5% (95% CI, -1.3% to 20.1%);

odds ratio, **1.63** (95% CI, 0.93 to 2.85); $P = .09$

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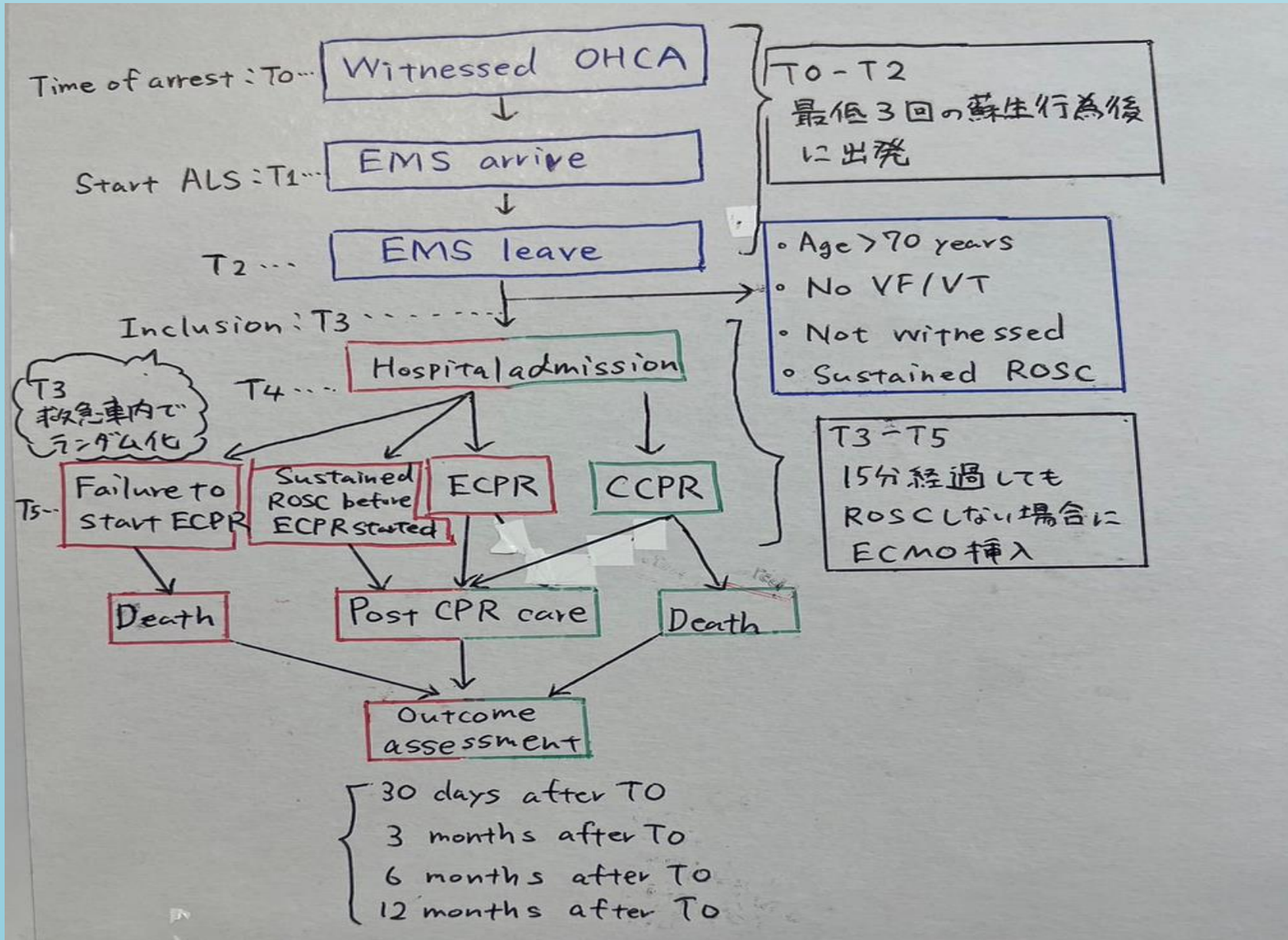
M.M. Suverein, T.S.R. Delnoij, R. Lorusso, G.J. Brandon Bravo Bruinsma, L. Otterspoor, C.V. Elzo Kraemer, A.P.J. Vlaar, J.J. van der Heijden, E. Scholten, C. den Uil, T. Jansen, B. van den Bogaard, M. Kuijpers, K.Y. Lam, J.M. Montero Cabezas, A.H.G. Driessen, S.Z.H. Rittersma, B.G. Heijnen, D. Dos Reis 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

Methods

オランダ、多施設ランダム化比較対照試験

- ・2017年5月～2021年2月、10施設のハートセンター
- ・18～70歳
- ・初期波形VF/VT
- ・難治性院外心停止患者(15分の高度救命処置にもかかわらずROSCしない)
- ・除外基準: 15分以内にROSC、末期心不全、重症肺疾患、播種性悪性腫瘍、妊娠、両側大腿部疾患、心停止からECPRまで60分以上かかることが予想、CPC3-4の患者

Study design

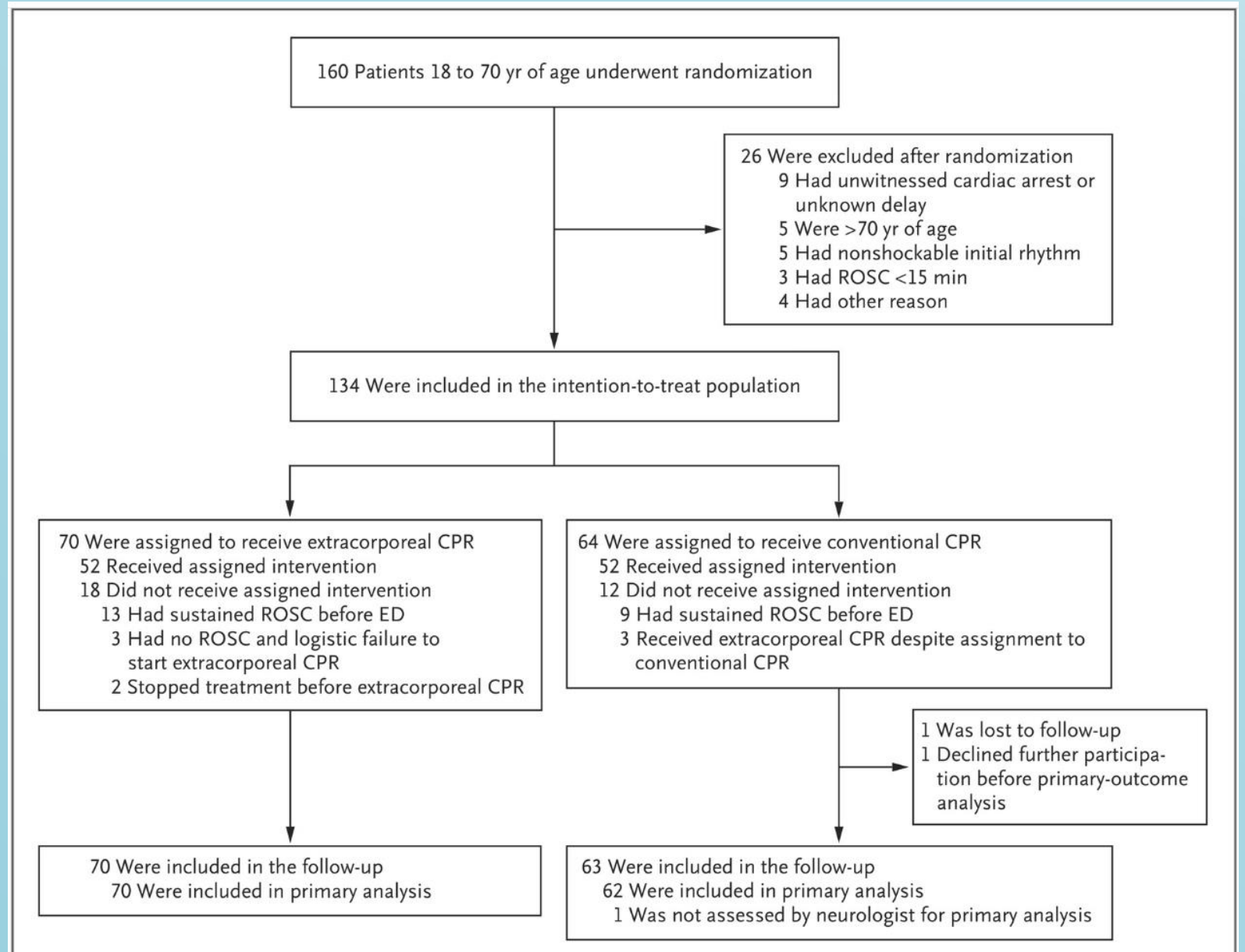


Primary endpoint

・30日後のCPCスコア1-2の
良好な脳神経学的所見で
の生存率

Secondary endpoint

・30日生存率、6か月生存率
・Intention-to-treat解析



Patient characteristics

- 年齢: ECPR 54歳、CCPR 57歳
- 男性 90%
- Witnesses 98%
- CPRを5分以内に開始: ECPR 99%、CCPR 95%
- 除細動の回数 8-9回
- 心停止の原因がAMI: ECPR 73%、CCPR 81%

Table 1. Characteristics of the Patients at Baseline.^a

Characteristic	Extracorporeal CPR (N = 70)	Conventional CPR (N = 64)
Age — yr	54±12	57±10
Male sex — no. (%)	63 (90)	57 (89)
Primary shockable rhythm — no. (%)	69 (99)	63 (98)
Arrest occurred at home — no. (%)	31 (44)	24 (38)
Witnessed arrest — no. (%)	68 (97)	63 (98)
CPR started ≤5 min after arrest — no. (%)	69 (99)	61 (95)
Total no. of defibrillations	8±5	9±6
Transport distance — no. of patients (km)	68 (17±10)	63 (16±11)
Cause of arrest — no. (%)		
Acute myocardial infarction	51 (73)	52 (81)
Secondary arrhythmia	11 (16)	11 (17)
Pulmonary embolus	1 (1)	0
Metabolic or electrolyte	1 (1)	0
Neurologic	0	1 (2)
Intoxication	1 (1)	0
Other†	5 (7)	0
Medical history — no./total no. (%)		
Acute coronary syndrome	10/61 (16)	10/55 (18)
Coronary artery disease	7/61 (12)	6/53 (11)
PCI	5/62 (8)	5/53 (9)
CABG	2/62 (3)	4/54 (7)
Chronic heart failure	4/62 (6)	2/54 (4)
Cerebrovascular accident	3/61 (5)	9/54 (17)
Peripheral artery disease	2/61 (3)	4/54 (7)
Diabetes mellitus	10/62 (16)	6/54 (11)
Hypertension	24/44 (55)	15/33 (45)
Hypercholesterolemia	10/32 (31)	15/31 (48)
Current smoker	20/35 (57)	18/33 (55)

^a Plus-minus values are means ±SD. Percentages may not total 100 because of rounding. CABG denotes coronary-artery bypass grafting. CPR cardiopulmonary resuscitation, and PCI percutaneous coronary intervention.

† Causes were unknown (in 3 patients) or were associated with a genetic mutation or cardiac sarcoidosis (in 1 patient each).

Patient characteristics

Table 2. Intervals between Events.*

Interval		Extracorporeal CPR (N = 70)	Conventional CPR (N = 64)	Treatment Effect (95% CI)†
Start of arrest to EMS arrival — no.	心停止から救急車到着までの時間	69 (8±4)	63 (8±4)	0.0 (-1.3 to 1.3)
Start of arrest to start of EMS transport — no.	心停止から搬送開始までの時間	67 (21±9)	55 (25±9)	-4.1 (-7.2 to -0.9)
Start of arrest to randomization — no.	心停止からランダム化開始までの時間	70 (32±10)	64 (34±12)	-2.4 (-6.1 to 1.4)
Randomization before arrival at emergency department — no.	病院到着までにランダム化された割合	44 (63)	42 (66)	0.9 (0.4 to 1.8)‡
Start of arrest to arrival at emergency department — no.	心停止から病院到着までの時間	70 (36±12)	64 (38±11)	-2.1 (-6.0 to 1.7)
Start of arrest to ROSC — no. of patients	心停止からROSCまでの時間	17 (43±20)	19 (49±19)	-6.4 (-19.8 to 7.0)
Start of arrest to start of cannulation — no.	心停止からカニューレーションまでの時間	51 (58±13)	2§	
Hospital arrival to start of cannulation				
No. of patients		51	2§	
Median interval (IQR) — min		16 (11 to 22)	NA	
Start of arrest to start of ECLS flow				
No. of patients		44	2§	
Median interval (IQR) — min		74 (63 to 87)	NA	
Cannulation				
No. of patients		43	2§	
Median duration (IQR) — min		20 (11 to 25)	NA	

Patient characteristics

- ECPR開始: ECPR 74% vs CCPR 5%
- ECPR成功率: ECPR 88.5% vs CCPR 100%
- ROSC得られた: ECPR 26% vs CCPR 31%
- 初療室で挿入: ECPR 56%
- PCI施行: ECPR 49% vs CCPR 22%
- ECMO抜去までの時間: ECPR 26時間
- 院内死亡: ECPR 80% vs CCPR 80%
- 治療中止理由
ECPR 脳神経学的 43%、多臓器不全 27%
CCPR それ以上の治療なし 78%、多臓器不全 14%

Table 3. Clinical Outcomes.*

Outcome	Extracorporeal CPR (N=70)	Conventional CPR (N=64)	Odds Ratio (95% CI)†
Initiation of extracorporeal CPR — no. (%)	52 (74)	3 (5)	0.02 (0.0 to 0.6)
Cannulation and circulation successful	46 (66)	3 (5)	
Cannulation or circulation failed	6 (9)	0	
Patient died before ICU admission	2 (3)	0	
No initiation of extracorporeal CPR — no. (%)	18 (26)	61 (95)	58.7 (16.4 to 210.7)
Logistic failure	3 (4)	0	
Cessation of treatment	2 (3)	NA	
Stable ROSC	13 (19)	NA	
Randomly assigned to conventional CPR	NA	61 (100)	
ROSC — no./total no. (%)	18/70 (26)	20/64 (31)	1.3 (0.6 to 2.8)
ROSC before emergency department arrival	10/18 (56)	9/20 (45)	
ROSC after emergency department arrival	8/18 (44)	11/20 (55)	
Intermittent ROSC during resuscitation — no. (%)	27 (39)	22 (34)	0.8 (0.4 to 1.7)
Extracorporeal CPR performed in emergency department (vs. cardiac catheterization laboratory) — no. (%)	39 (56)	1 (2)	1.5 (0.1 to 18.0)
PCI — no. (%)	34 (49)	14 (22)	0.3 (0.2 to 0.6)
Admitted to ICU — no. (%)	57 (81)	23 (36)	0.1 (0.1 to 0.3)
Decannulation			
No. of patients	45	2‡	NA
Median interval from arrest to decannulation (IQR) — hr	26 (9–53)	NA	NA
ICU stay		4 (1–9)	
No. of patients	58	24	
Median duration (IQR) — days	1 (1–4)	4 (1–9)	NA§
Hospitalization			
No. of patients	55	23	
Median duration (IQR) — days	2 (2–14)	18 (2–30)	NA§
Death after ICU admission			
No. of patients	44	10	
Interval from arrest to death — days	3±6	5±6	–1.5 (–5.8 to 2.8)
Survived to ICU discharge — no. (%)	14 (20)	15 (23)	1.2 (0.5 to 2.8)
Survived to hospital discharge — no. (%)	14 (20)	13 (20)	1.0 (0.4 to 2.4)
Discontinued treatment — no./total no. (%)	56/70 (80)	51/64 (80)	1.0 (0.4 to 2.3)
Neurologically unfavorable	24/56 (43)	4/51 (8)	
Multiple organ failure	15/56 (27)	7/51 (14)	
Cannulation or ECLS failure	8/56 (14)	0	
No more treatment options	5/56 (9)	40/51 (78)	
Other	4/56 (7)	0	

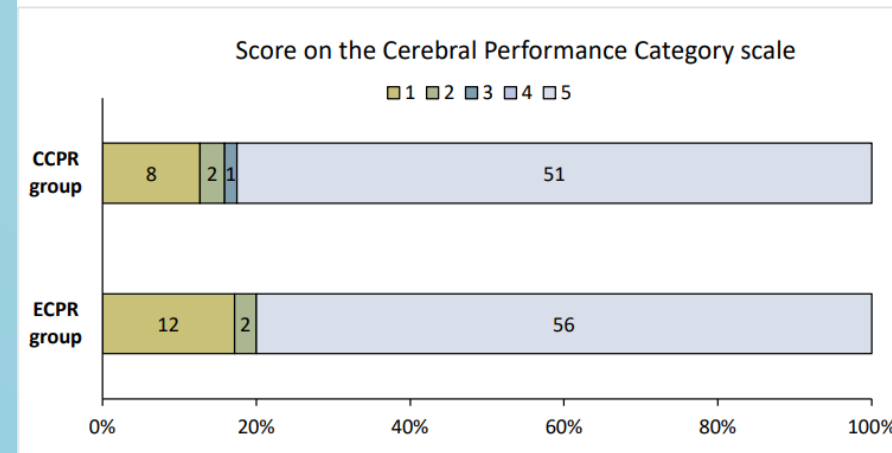
Result

脳神経学的予後良好な生存は短期も中長期も変わらない

Table 4. Survival with Favorable Neurologic Outcome.*

Outcome	Extracorporeal CPR (N=70)	Conventional CPR (N=63)†	Odds Ratio (95% CI)	P Value	Risk Ratio (95% CI)
Primary outcome: 30-day survival with favorable neurologic outcome — no./total no. (%)	14/70 (20)	10/62 (16)‡	1.4 (0.5–3.5)	0.52	1.05 (0.97–1.13)
Secondary outcomes — no./total no. (%)					
3-month survival with favorable neurologic outcome	12/68 (18)	9/63 (14)	1.5 (0.6–3.8)		
6-month survival with favorable neurologic outcome	14/70 (20)	10/63 (16)	1.3 (0.5–3.3)		

Figure S3. Survival with a favorable neurologic outcome at 30 days



Discussion

- ・入院からカニューレーション開始までの間隔の中央値は16分 vs 12分(プラハの単施設)7分(ARREST 試験)、カニューレーション開始から体外式膜酸素化流量開始までの間隔の中央値は20分
➡ECPRの経験の差であり大都市の病院とは異なった。
- ・搬送までにROSCした患者が多かった

Discussion

- ・ECPRは実臨床で優れた能力を発揮するのを体験することがあるが、使用経験のある医療従事者がいる施設でさえ、その優れた結果の再現性がないことを示唆している。体外式心肺蘇生法を実施している施設または実施中の施設は、批判的に評価し、この手技の有効性を評価すべきである。
- ・今後の研究では、適応と転帰の予後因子について検討する必要がある。

Conclusion

・ショック適応の難治性院外心停止患者において、体外式心肺蘇生と従来の心肺蘇生は、30日の良好な神経学的転帰および生存に対して同様の効果であった