Role of Microaxial Flow Pump in Cardiogenic Shock Secondary to ACS

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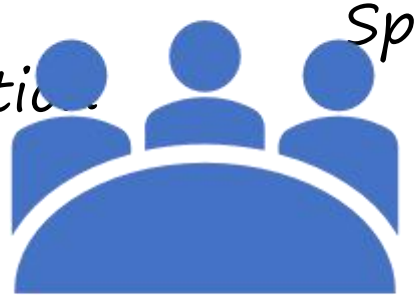
Disclosure

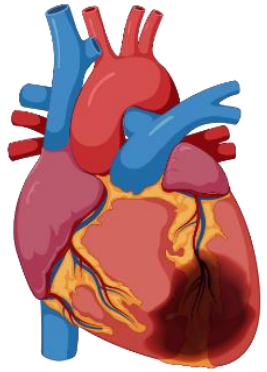
Institutional research grant
Abiomed, Novo Nordic Foundation

Speakers fee Abbott, Boehringer Ingelheim

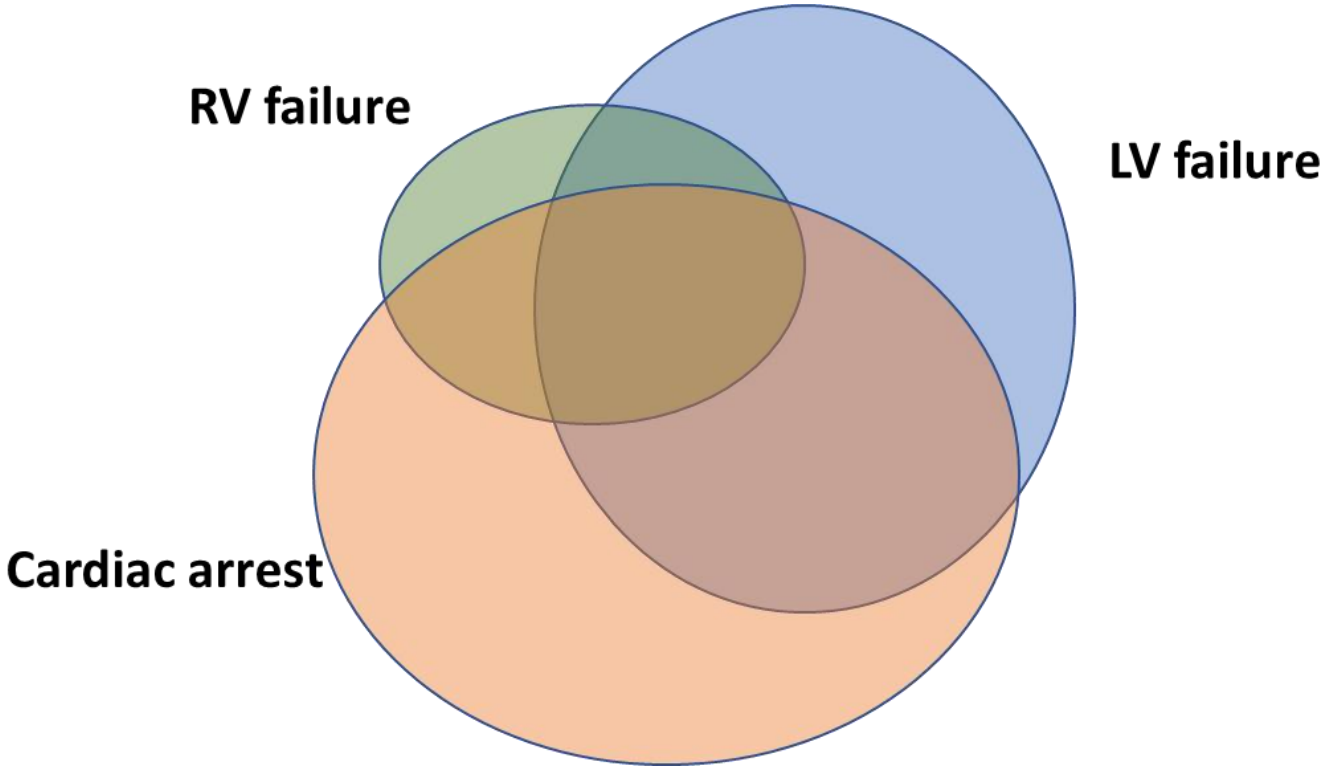


Advisory board Boston Scientific

CARDIOGENIC SHOCK IS A SEVERE COMplication that occurs in approximately 8 to 10% of patients with ST-segment elevation myocardial infarction (STEMI)[1,2] and is associated with a mortality of 40 to 50%.[2,3] Among

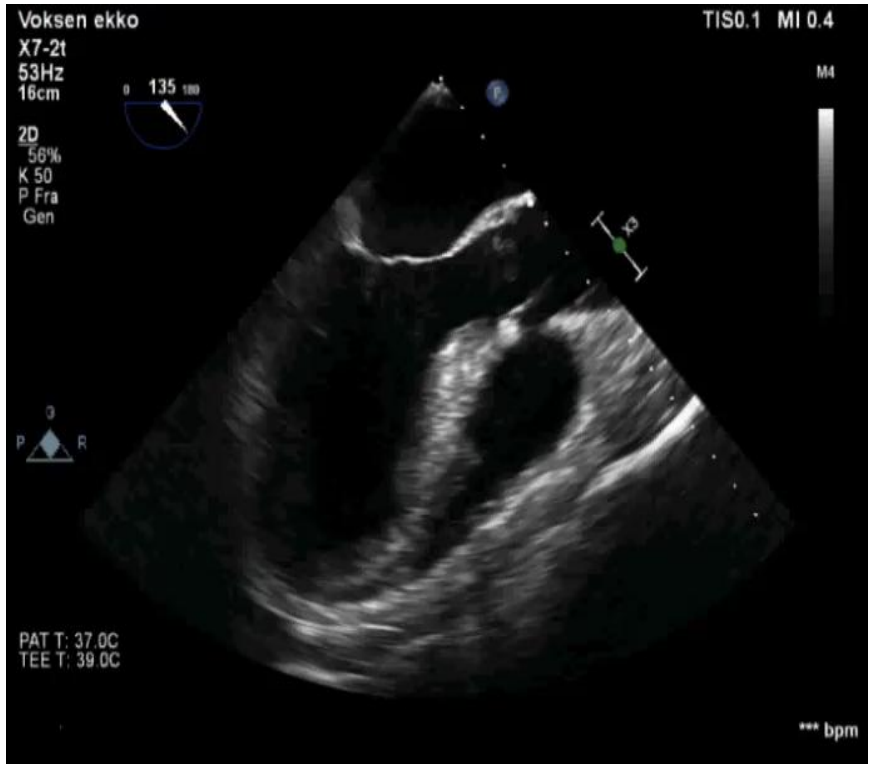


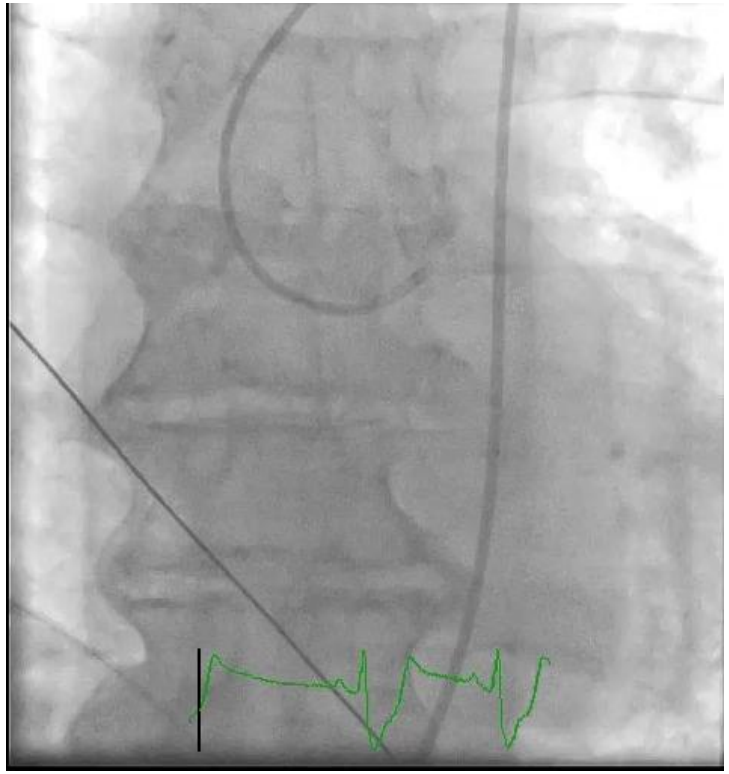
Phenotype



Case LV predominant AMI-CS

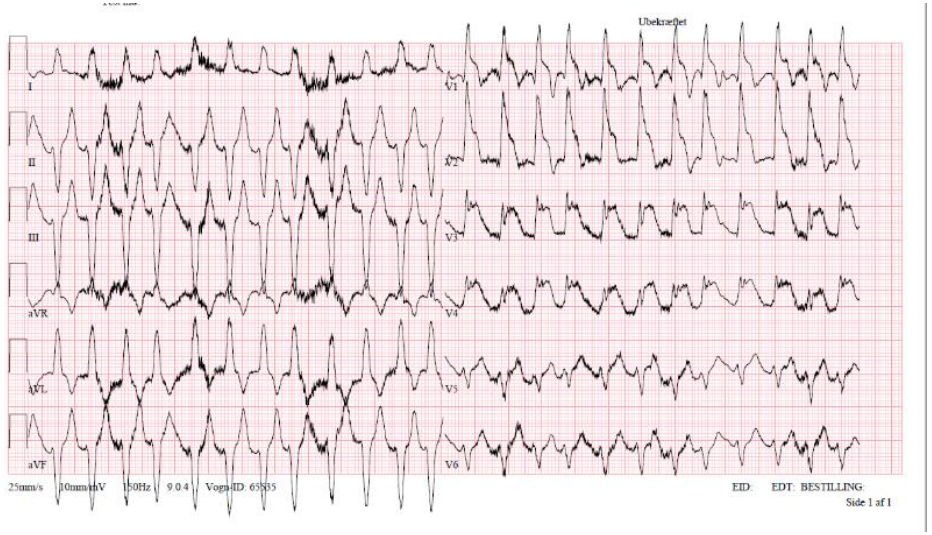
- 60 yrs old, STEMI
- Cold, confused
- BP 65/40 mmHg minimal effect of bolus epinephrine
- Lactate 7.4 mmol/l

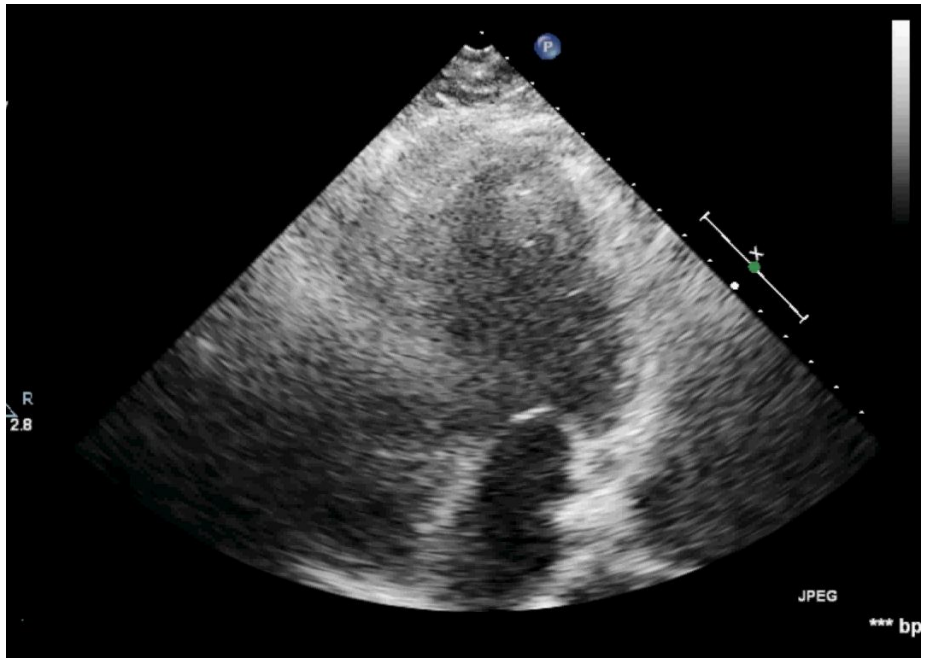




Case cardiac arrest AMI-CS

- 65 year female history of hypertension
- Witnessed cardiac arrest, bystander CPR, Shockable rhythm
- ROSC 25 min Comatose after ROSC
- BP 85/50 mmHg
- Lactate 9.2 mmol/L





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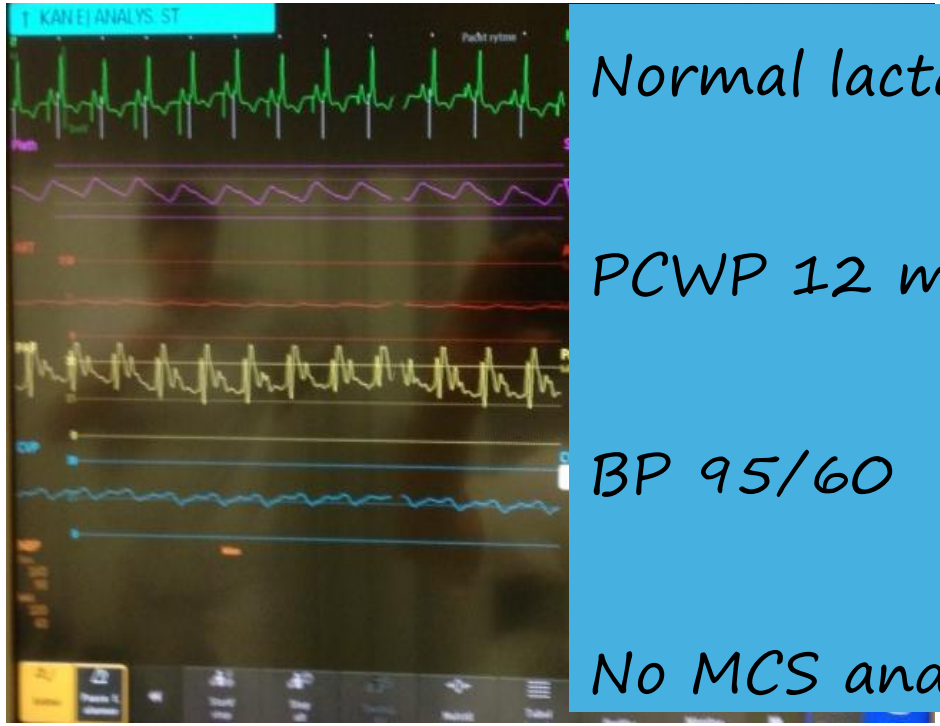
4 hours after revascularization in CICU



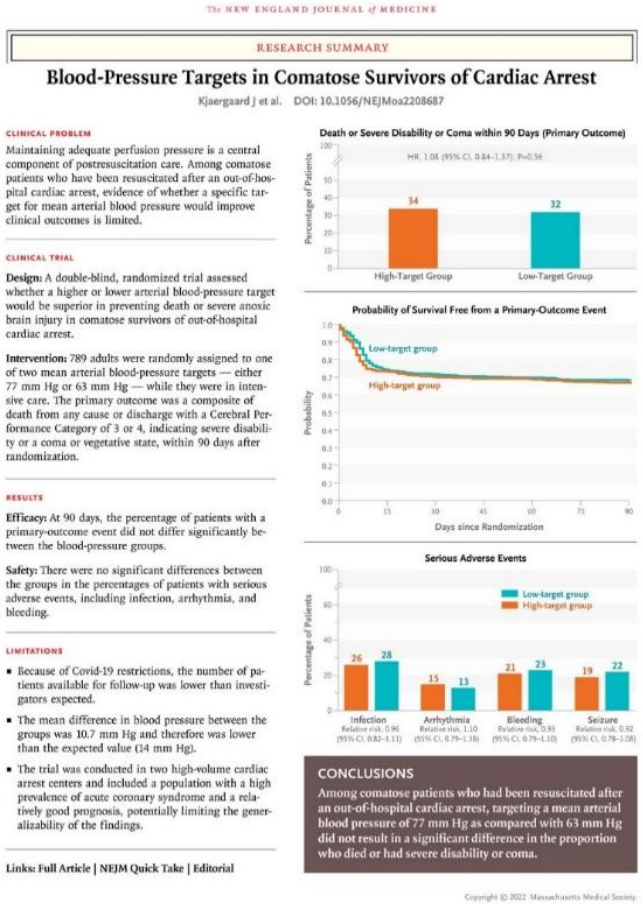
Normal lactate, SVO2 66%,

PCWP 12 mmHg,

BP 95/60

No MCS and 0.04 µg/kg/min NE

Most cardiac arrest patients do not need MCS



The NEW ENGLAND JOURNAL of MEDICINE

RESEARCH SUMMARY

Blood-Pressure Targets in Comatose Survivors of Cardiac Arrest

Kjaergaard J et al. DOI: 10.1056/NEJMoa2208687

CLINICAL PROBLEM

Maintaining adequate perfusion pressure is a central component of postresuscitation care. Among comatose patients who have been resuscitated after an out-of-hospital cardiac arrest, evidence of whether a specific target for mean arterial blood pressure would improve clinical outcomes is limited.

CLINICAL TRIAL

Design: A double-blind, randomized trial assessed whether a higher or lower arterial blood-pressure target would be superior in preventing death or severe anoxic brain injury in comatose survivors of out-of-hospital cardiac arrest.

Intervention: 789 adults were randomly assigned to one of two mean arterial blood-pressure targets — either 77 mm Hg or 63 mm Hg — while they were in intensive care. The primary outcome was a composite of death from any cause or discharge with a Cerebral Performance Category of 3 or 4, indicating severe disability or a coma or vegetative state, within 90 days after randomization.

RESULTS

Efficacy: At 90 days, the percentage of patients with a primary-outcome event did not differ significantly between the blood-pressure groups.

Safety: There were no significant differences between the groups in the percentages of patients with serious adverse events, including infection, arrhythmia, and bleeding.

LIMITATIONS

- Because of Covid-19 restrictions, the number of patients available for follow-up was lower than investigators expected.
- The mean difference in blood pressure between the groups was 10.7 mm Hg and therefore was lower than the expected value (14 mm Hg).
- The trial was conducted in two high-volume cardiac arrest centers and included a population with a high prevalence of acute coronary syndrome and a relatively good prognosis, potentially limiting the generalizability of the findings.

Links: Full Article | NEJM Quick Take | Editorial

Death or Severe Disability or Coma within 90 Days (Primary Outcome)

HR, 1.08 (95% CI, 0.84–1.37); P=0.56

Percentage of Patients

34 32

High-Target Group Low-Target Group

Probability of Survival Free from a Primary-Outcome Event

Low-target group

High-target group

Probability

Days since Randomization

Serious Adverse Events

Low-target group

High-target group

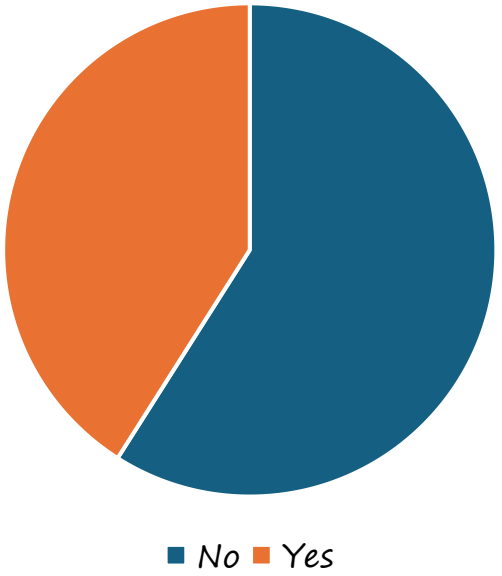
Percentage of Patients

	Infection	Arrhythmia	Bleeding	Seizure
Relative risk, 95% CI	0.96 (0.82–1.11)	1.10 (0.79–1.38)	0.93 (0.79–1.10)	0.92 (0.78–1.08)
High-target group	26	15	21	19
Low-target group	28	13	23	22

CONCLUSIONS

Among comatose patients who had been resuscitated after an out-of-hospital cardiac arrest, targeting a mean arterial blood pressure of 77 mm Hg as compared with 63 mm Hg did not result in a significant difference in the proportion who died or had severe disability or coma.

Eligible for ECLS-SHOCK



1%

37% at 1-year

BOX trial - 789 resuscitated comatose OHCA patients

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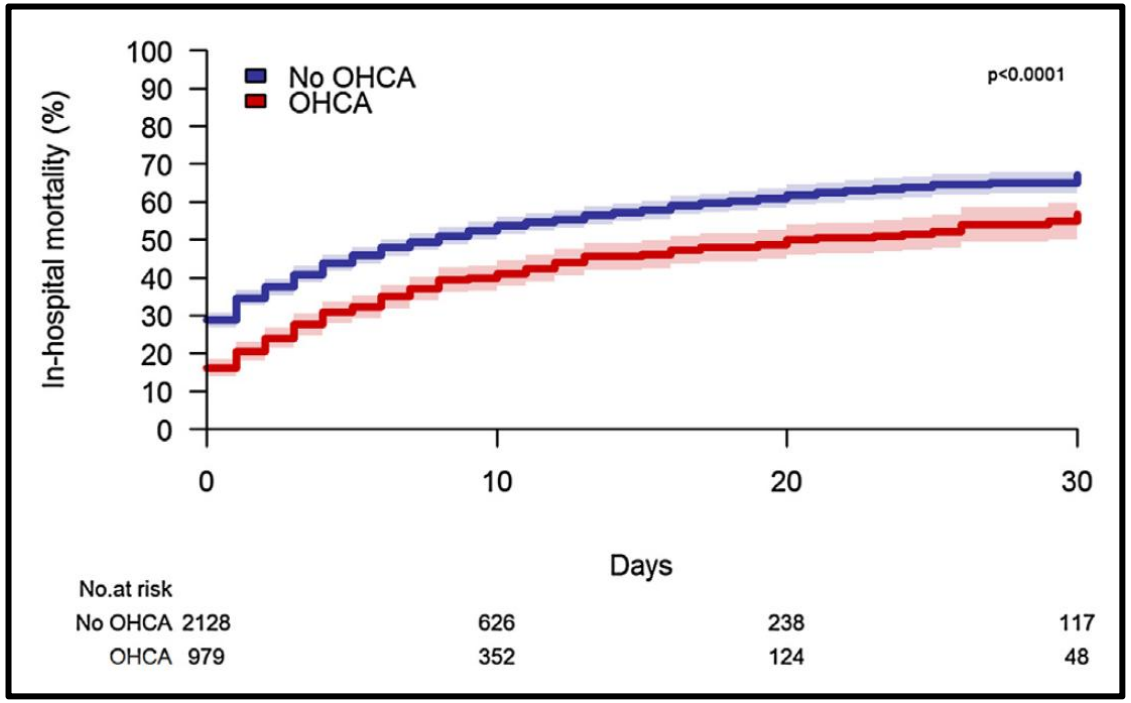
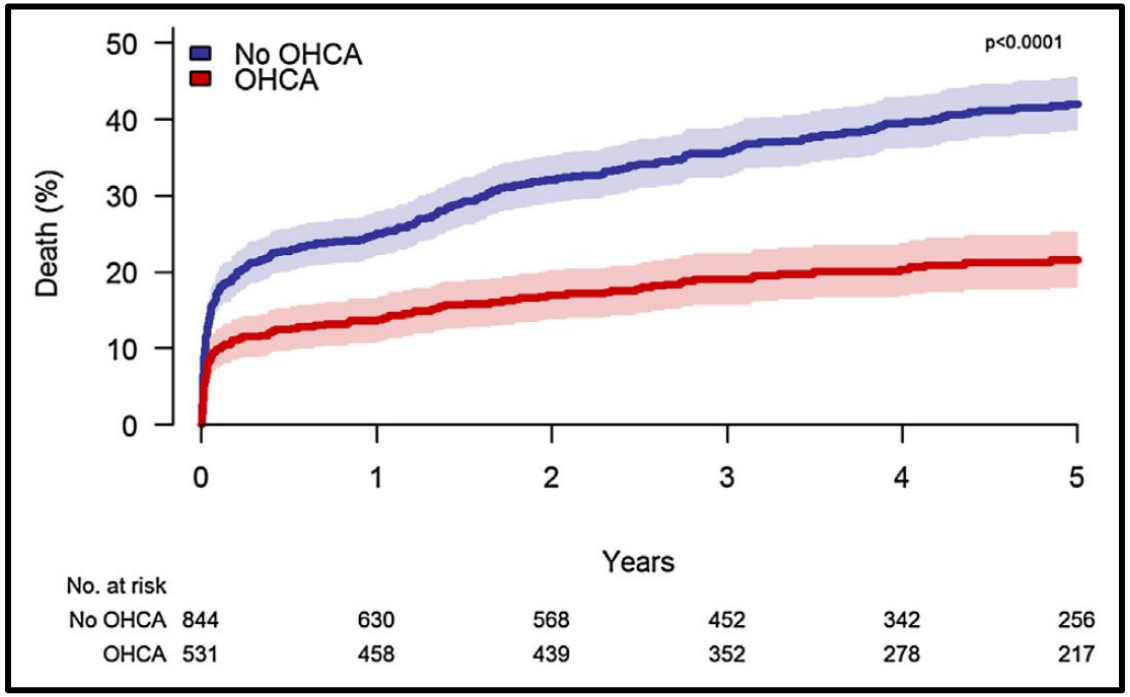
'Paradoxal' prognosis in OHCA AMICS



Those who survive until discharge



Lauridsen MD et al. Resuscitation 2021:162:135-142

Nationwide data from Denmark

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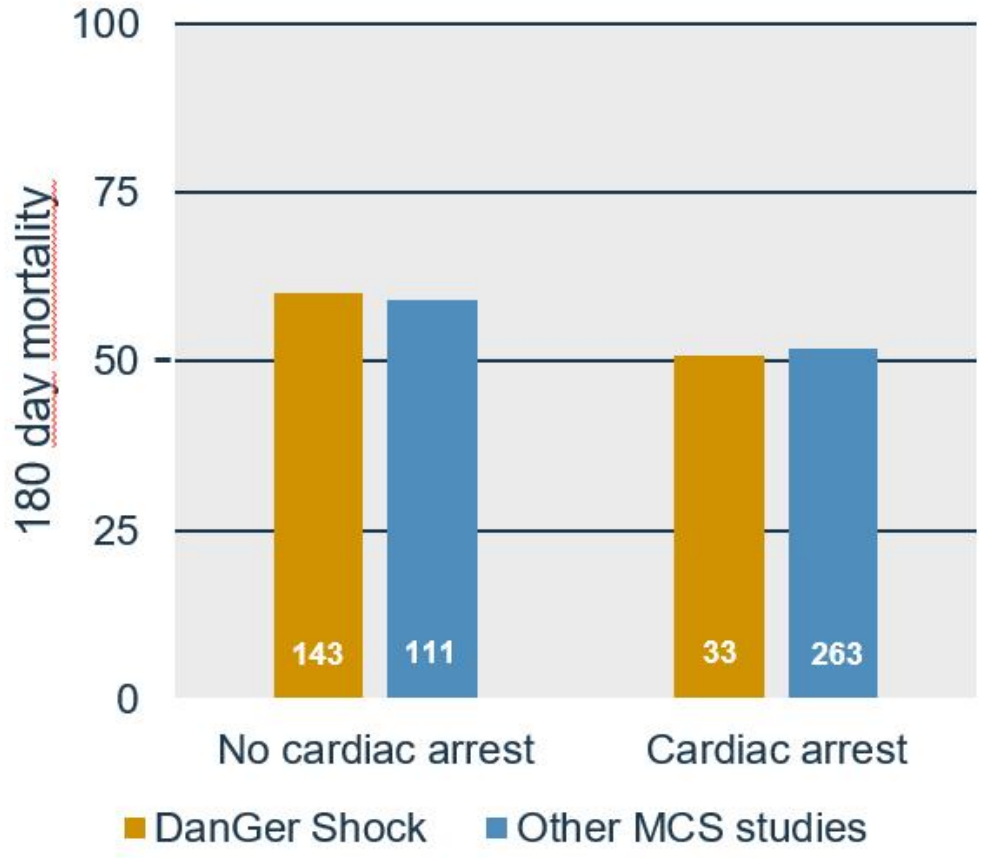
We see the same in conservatively managed patients from MCS trials



www.thelancet.com
THE LANCET

Temporary mechanical circulatory support in infarct-related cardiogenic shock: an individual patient data meta-analysis of randomised trials with 6-month follow-up

Holger Thiele, Jacob E Møller*, Jose P S Henriques, Margriet Bogerd, Melchior Seyfarth, Daniel Burkhoff, Petr Ostadal, Richard Rokyta, Jan Belohlavek, Steffen Massberg, Marcus Flather, Matthias Hochadel, Steffen Schneider, Steffen Desch, Anne Freund, Hans Eiskjær, Norman Mangner, Janine Poss, Amin Polzin, P Christian Schulze, Carsten Skurk, Uwe Zeymer†, Christian Hassager†, on behalf of the MCS Collaborator Scientific Group†*

MCS intuitive for low cardiac output shock

Møller Helgestad et al Eurointervention 2019

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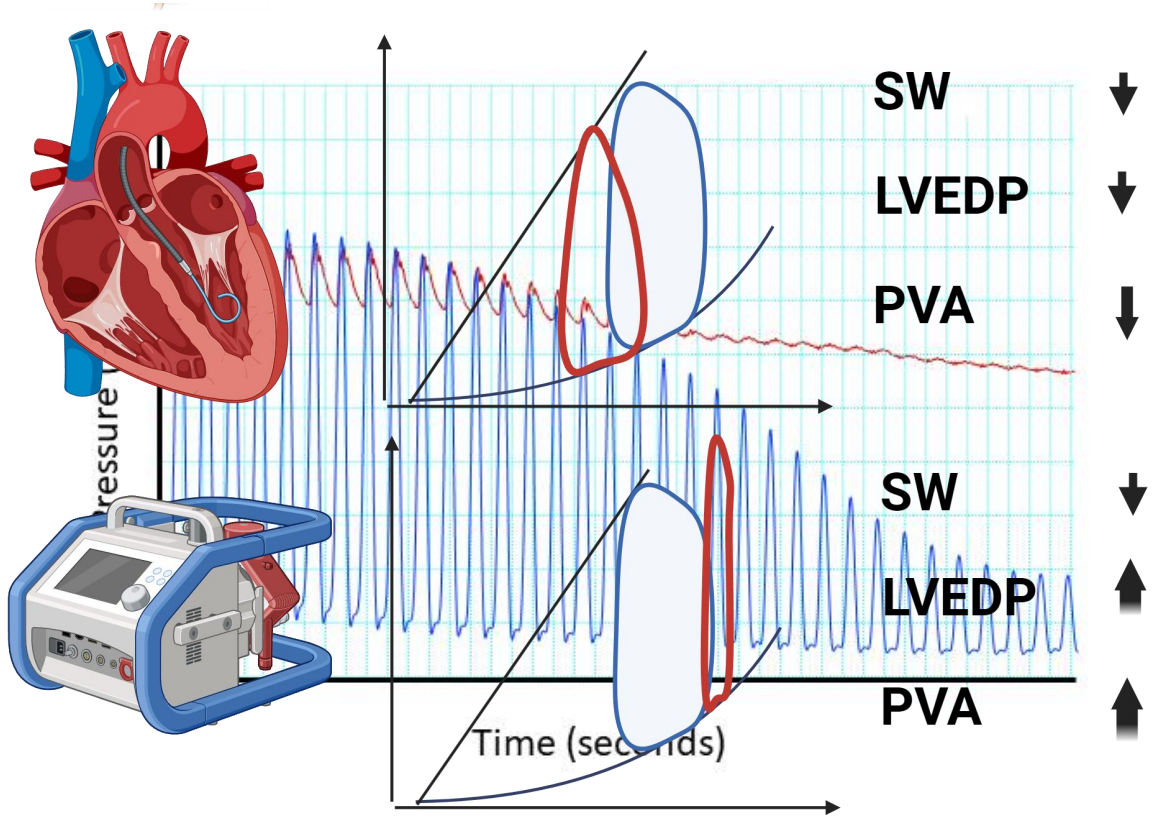
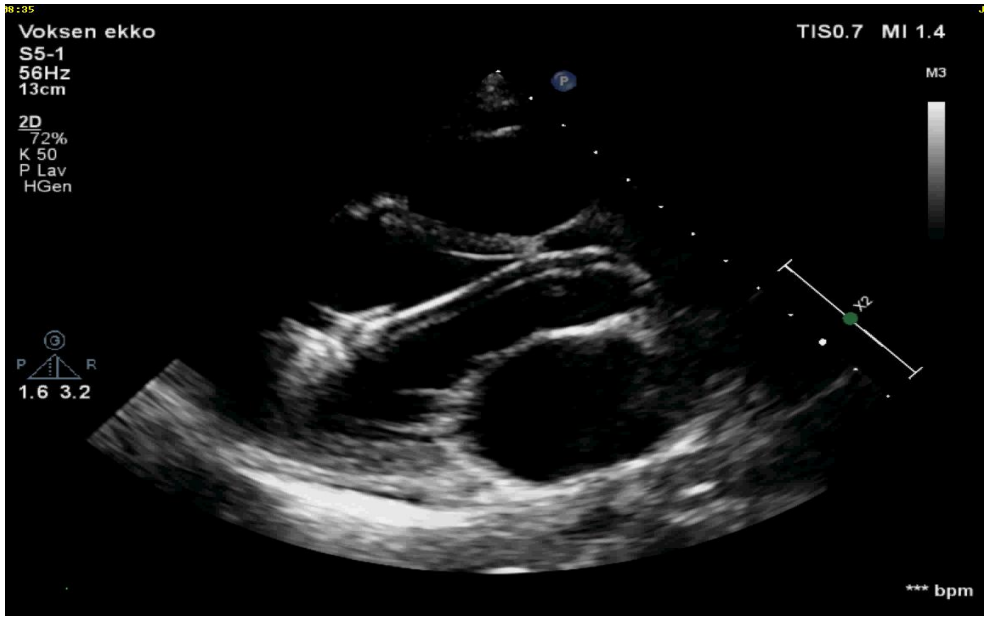
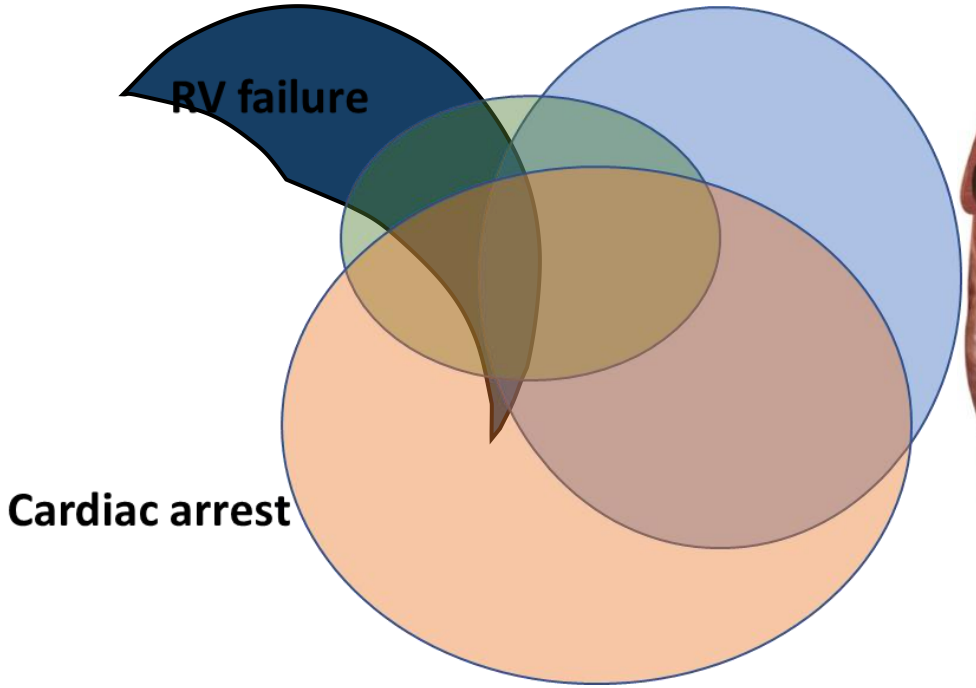
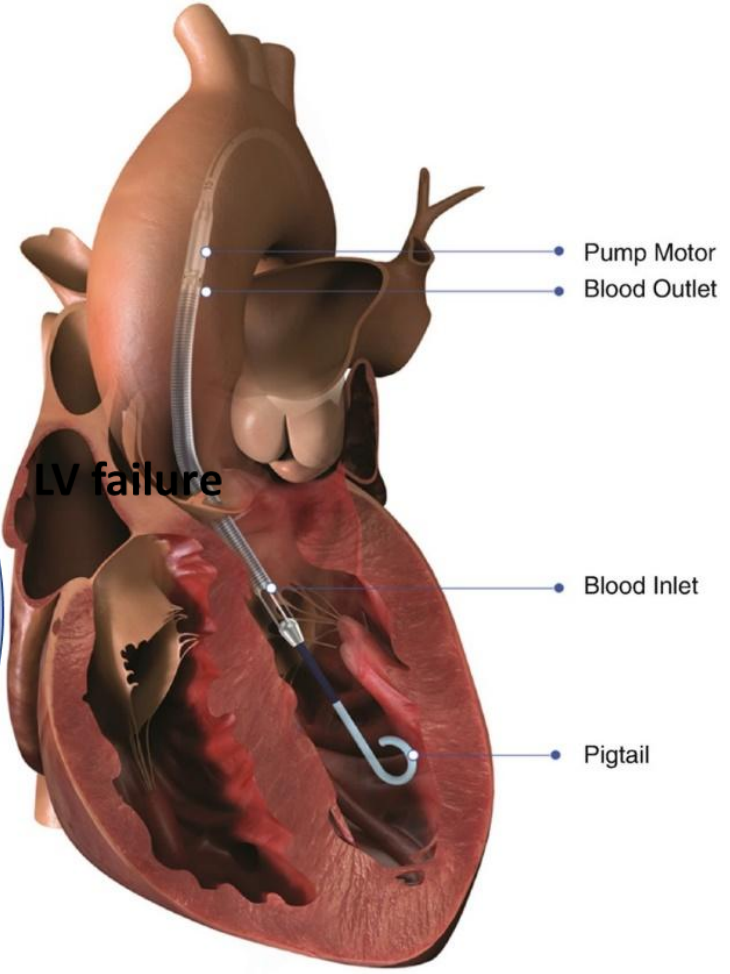
Non pulsatility





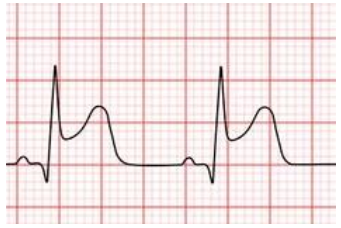
Most likely to benefit?





Micro Axial Flow Pump

Inclusion



STEMI

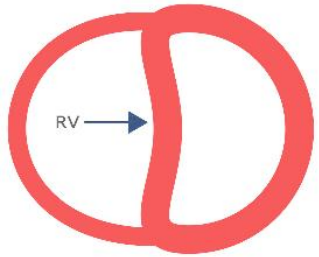
Hypotension and hypoperfusion

LVEF < 45%

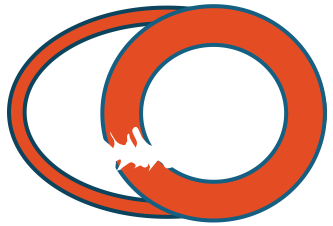
Randomization when shock was diagnosed

Exclusion

Comatose OHCA



RV failure



Mechanical complication

STEMI

Cardiogenic shock

LVEF<45%

Patients characteristics – N=355

Median 67 years
79% male

Median 4 hrs from onset of STEMI symptoms to randomization

84% randomized in cath lab

Median lactate 4.5 mmol/L

Median LVEF
25%

Median systolic BP 82 mmHg

72% LAD or LM culprit
72% Multi vessel disease

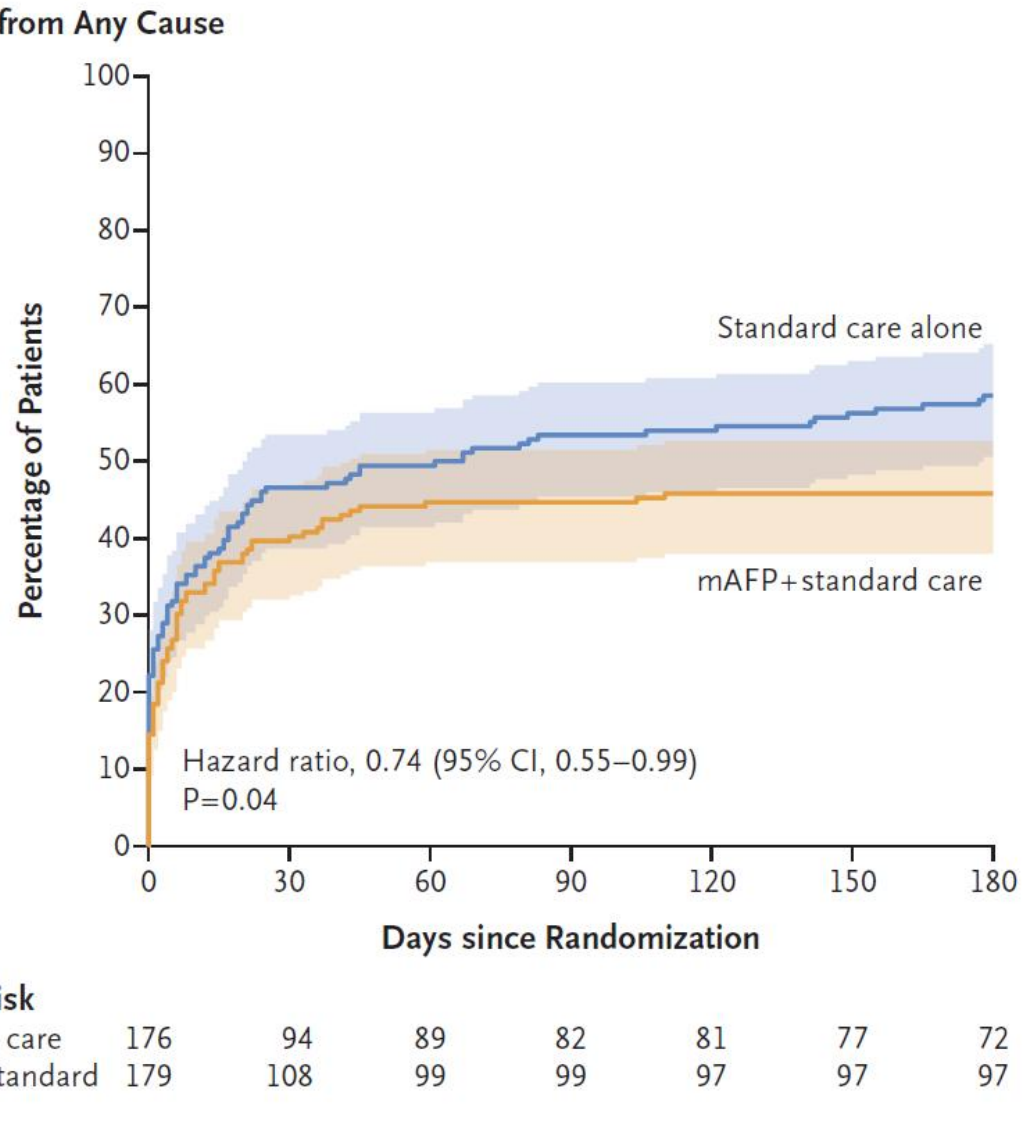
SCAI

55% SCAI class C
45% SCAI class D or E

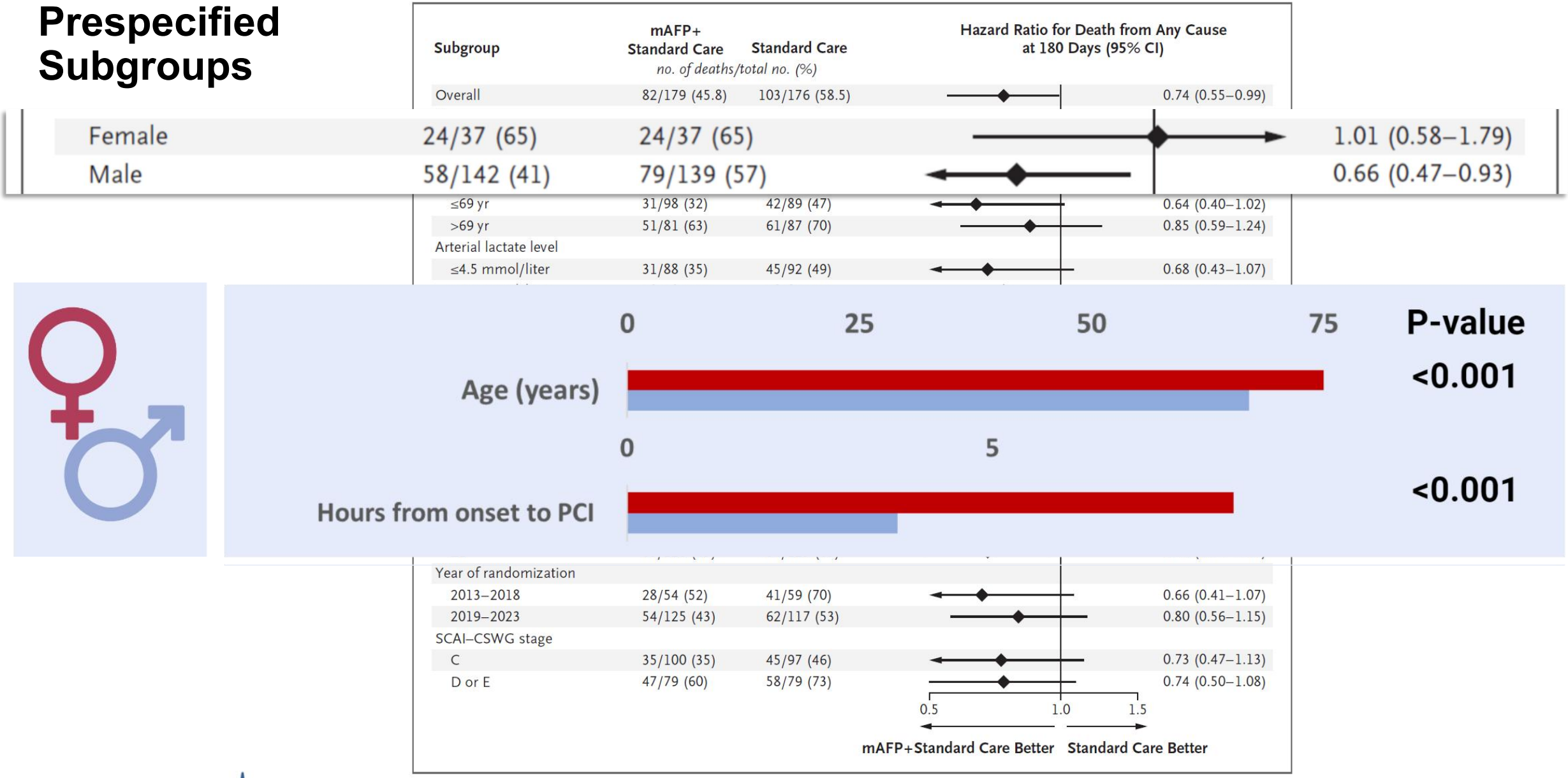
Primary endpoint

Absolute 12.7% reduction

NNT 8



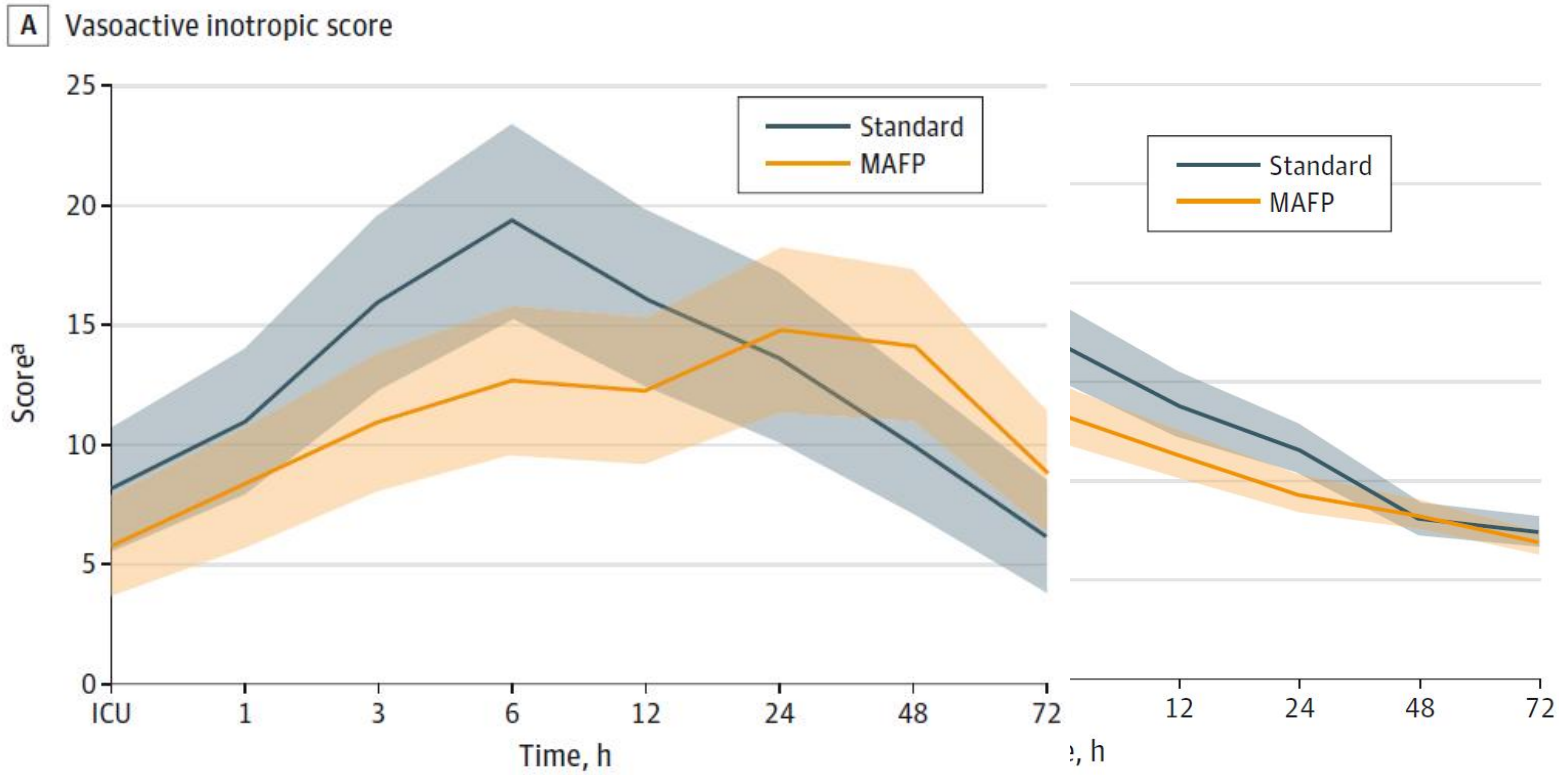
Prespecified Subgroups



DanGer Shock

Danish German Cardiogenic Shock trial

CICU mangement

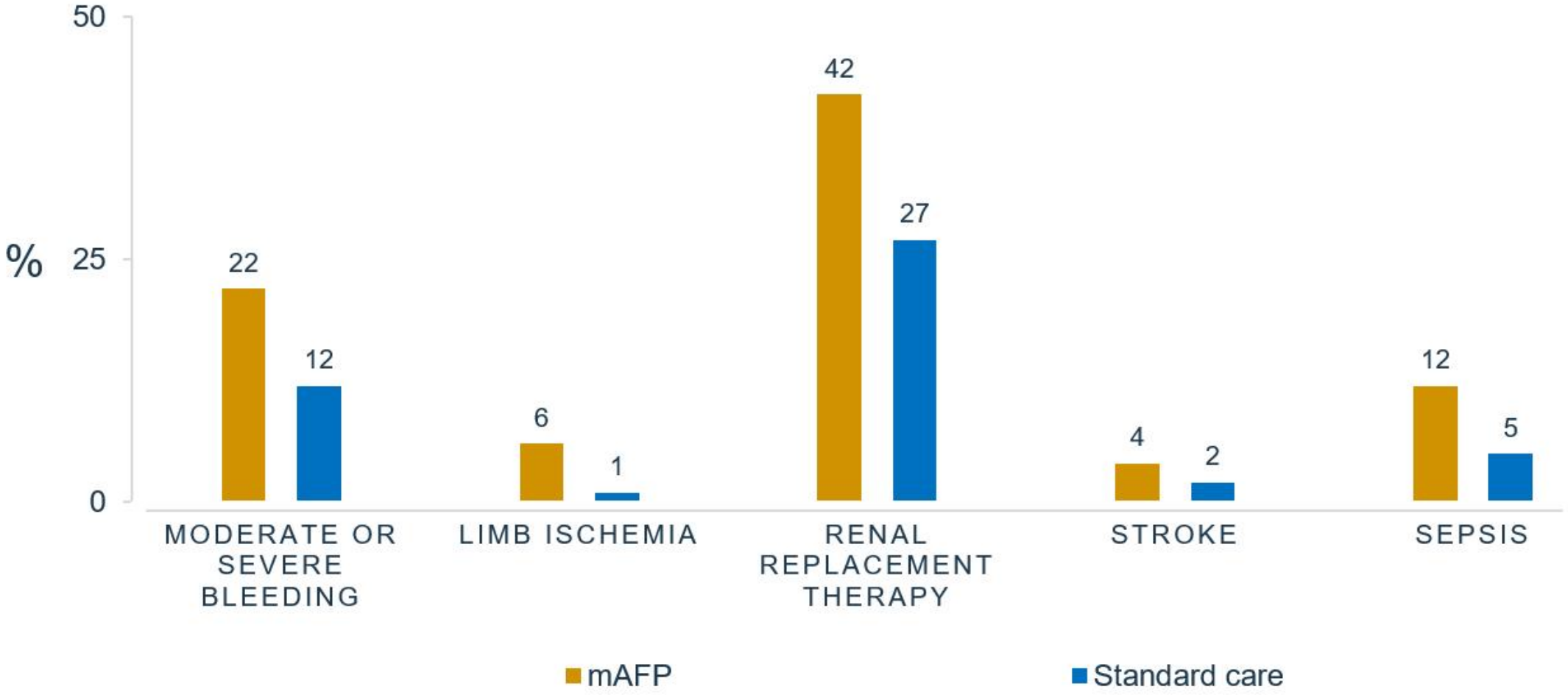


Reduced need for vasopressors and inotropes

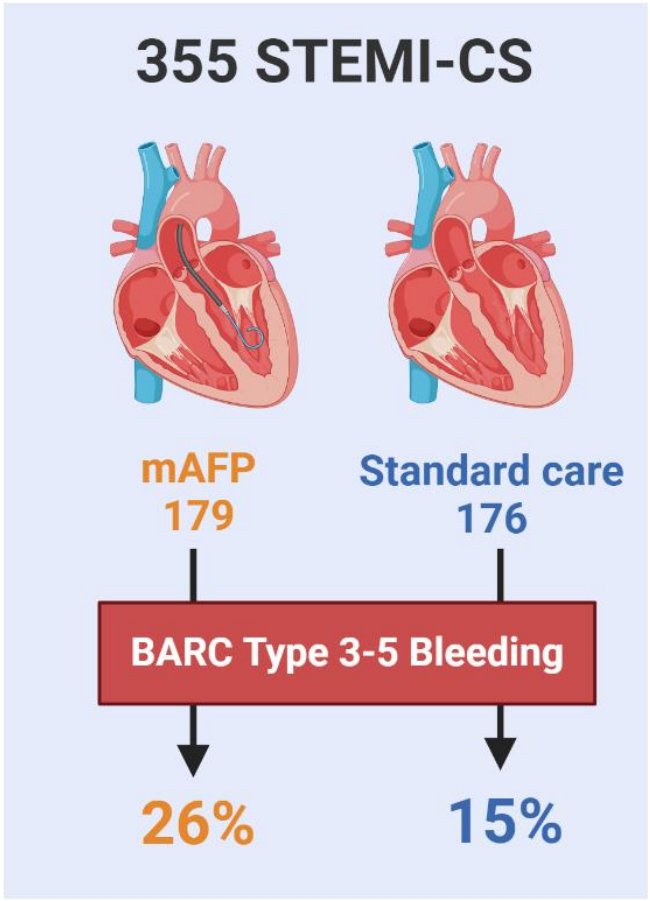
Faster lactate clearance

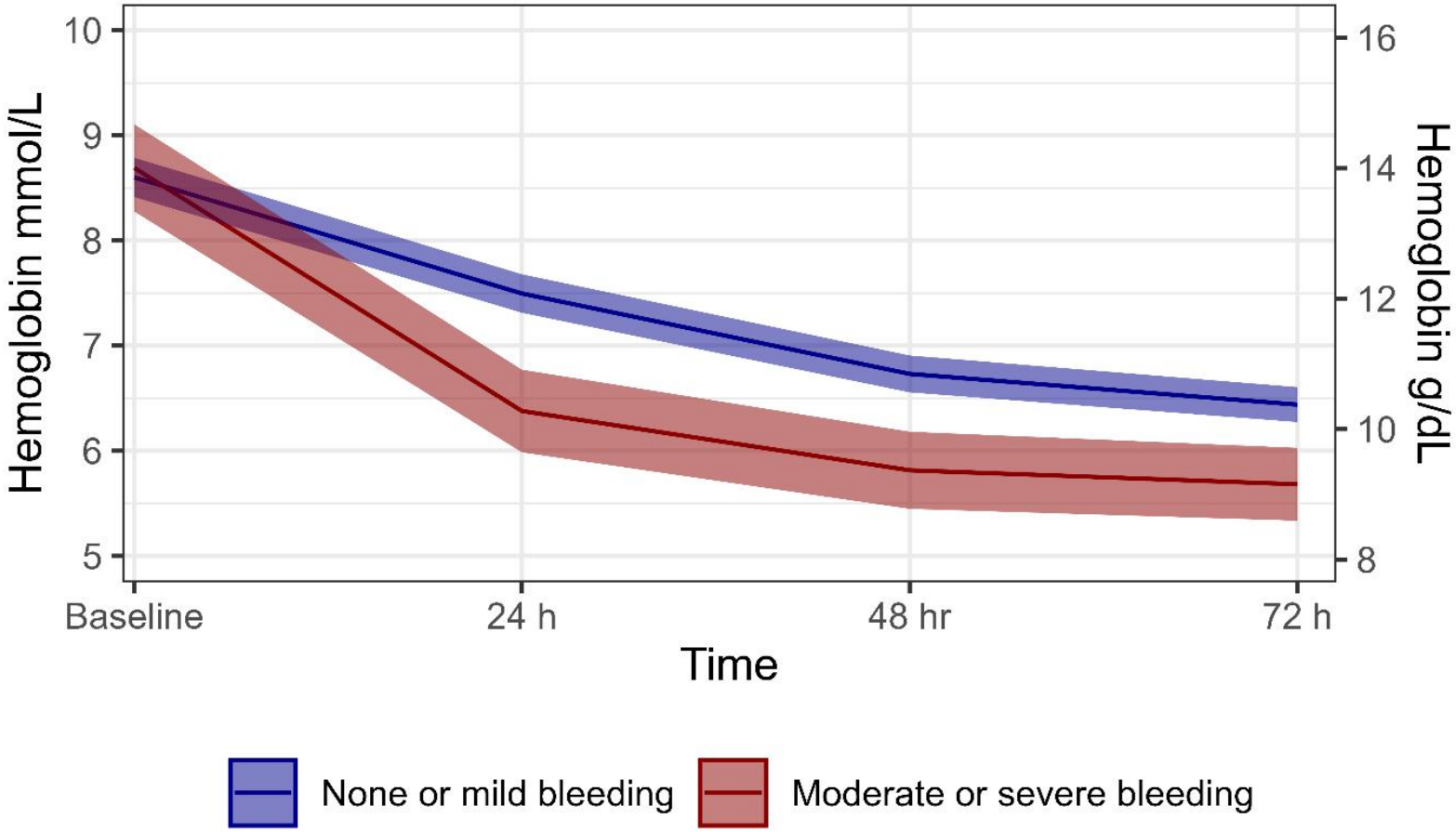
Udesen NLJ et al JAMA Cardiol 2024

Adverse events



Bleeding

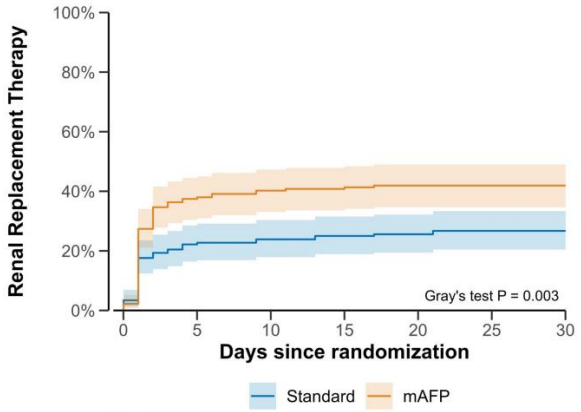


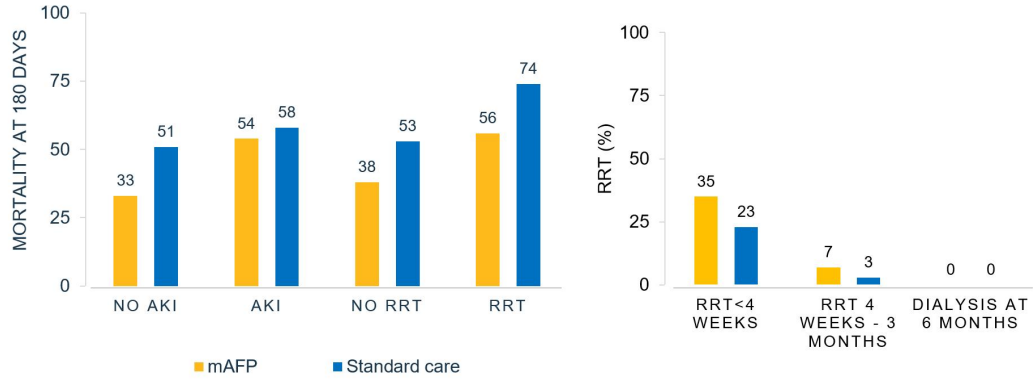


DanGer Shock
Danish German Cardiogenic Shock trial

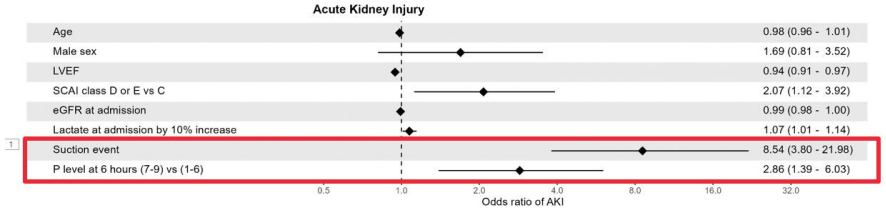
Sørensen R TCT 2024

Acute kidney injury and renal rent therapy

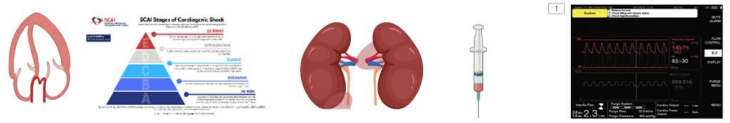




Risk of AKI and RRT is increased with mAFP



AKI is associated with higher mortality but kidney function recovers in survivors



Risk was associated with disease severity but also to device related factors

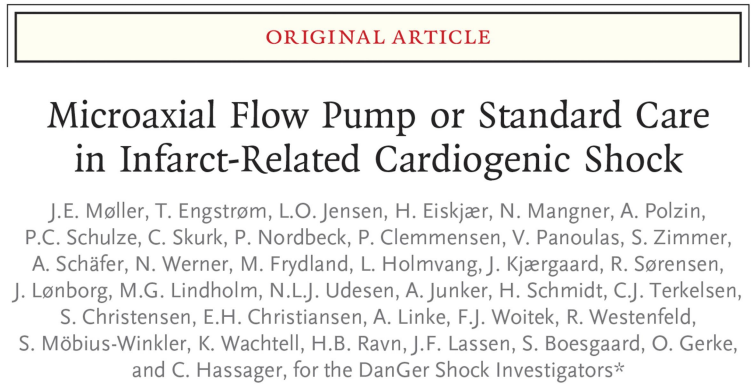
DanGer Shock
Danish German Cardiogenic Shock trial

Zweick E et al Circulation 2024

- *The use of a mAFP on top of standard care* ***reduced death*** *from any cause in* ***selected patients with STEMI and cardiogenic shock.***

- *mAFP was associated with* ***less need for vasopressors and faster lactate clearance***

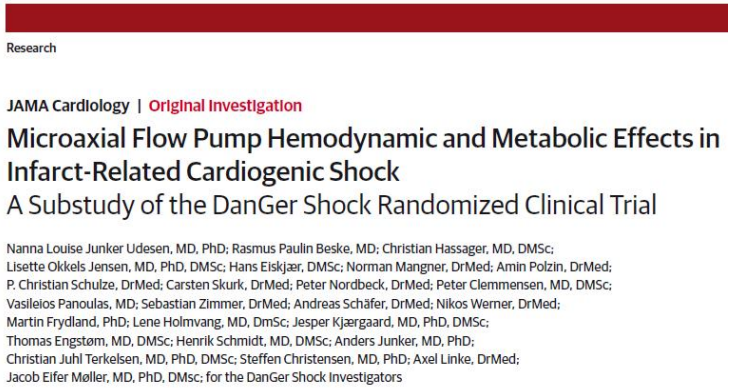
- *This was associated with an* ***increased risk of device related bleeding, AKI, and limb ischemia.***



ORIGINAL ARTICLE

Microaxial Flow Pump or Standard Care in Infarct-Related Cardiogenic Shock

J.E. Møller, T. Engstrøm, L.O. Jensen, H. Eiskjær, N. Mangner, A. Polzin, P.C. Schulze, C. Skurk, P. Nordbeck, P. Clemmensen, V. Panoulas, S. Zimmer, A. Schäfer, N. Werner, M. Frydland, L. Holmvang, J. Kjærgaard, R. Sørensen, J. Lønborg, M.G. Lindholm, N.L.J. Udesen, A. Junker, H. Schmidt, C.J. Terkelsen, S. Christensen, E.H. Christiansen, A. Linke, F.J. Woitek, R. Westenfeld, S. Möbius-Winkler, K. Wachtell, H.B. Ravn, J.F. Lassen, S. Boesgaard, O. Gerke, and C. Hassager, for the DanGer Shock Investigators*



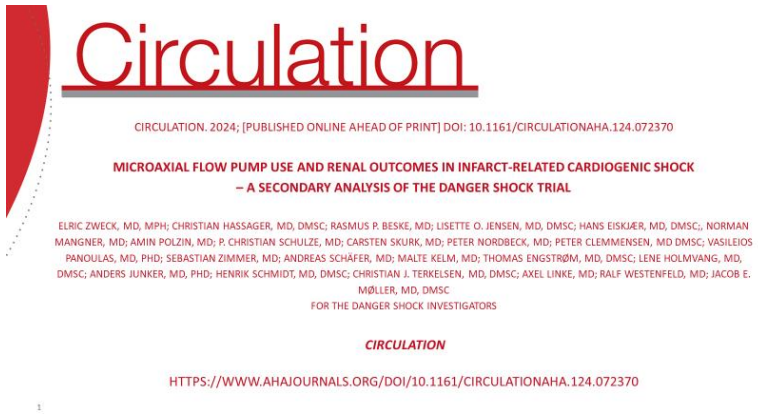
Research

JAMA Cardiology | Original Investigation

Microaxial Flow Pump Hemodynamic and Metabolic Effects in Infarct-Related Cardiogenic Shock

A Substudy of the DanGer Shock Randomized Clinical Trial

Nanna Louise Junker Udesen, MD, PhD; Rasmus Paulin Beske, MD; Christian Hassager, MD, DMSc; Lisette Okkels Jensen, MD, PhD, DMSc; Hans Eiskjær, DMSc; Norman Mangner, DrMed; Amin Polzin, DrMed; P. Christian Schulze, DrMed; Carsten Skurk, DrMed; Peter Nordbeck, DrMed; Peter Clemmensen, MD, DMSc; Vasileios Panoulas, MD; Sebastian Zimmer, DrMed; Andreas Schäfer, DrMed; Nikos Werner, DrMed; Martin Frydland, PhD; Lene Holmvang, MD, DmSc; Jesper Kjærgaard, MD, PhD, DMSc; Thomas Engstøm, MD, DMSc; Henrik Schmidt, MD, DMSc; Anders Junker, MD, PhD; Christian Juhl Terkelsen, MD, PhD, DMSc; Steffen Christensen, MD, PhD; Axel Linke, DrMed; Jacob Eifer Møller, MD, PhD, DMsc; for the DanGer Shock Investigators



Circulation

CIRCULATION. 2024; [PUBLISHED ONLINE AHEAD OF PRINT] DOI: 10.1161/CIRCULATIONAHA.124.072370

MICROAXIAL FLOW PUMP USE AND RENAL OUTCOMES IN INFARCT-RELATED CARDIOGENIC SHOCK – A SECONDARY ANALYSIS OF THE DANGER SHOCK TRIAL

ELRIC ZWECK, MD, MPH; CHRISTIAN HASSAGER, MD, DMSC; RASMUS P. BESKE, MD; LISETTE O. JENSEN, MD, DMSC; HANS EISKJÆR, MD, DMSC;, NORMAN MANGNER, MD; AMIN POLZIN, MD; P. CHRISTIAN SCHULZE, MD; CARSTEN SKURK, MD; PETER NORDBECK, MD; PETER CLEMMENSEN, MD DMSC; VASILEIOS PANOULAS, MD, PHD; SEBASTIAN ZIMMER, MD; ANDREAS SCHÄFER, MD; MALTE KELM, MD; THOMAS ENGSTRØM, MD, DMSC; LENE HOLMVANG, MD, DMSC; ANDERS JUNKER, MD, PHD; HENRIK SCHMIDT, MD, DMSC; CHRISTIAN J. TERKELSEN, MD, DMSC; AXEL LINKE, MD; RALF WESTENFELD, MD; JACOB E. MØLLER, MD, DMSC
FOR THE DANGER SHOCK INVESTIGATORS

CIRCULATION

HTTPS://WWW.AHAJOURNALS.ORG/DOI/10.1161/CIRCULATIONAHA.124.072370

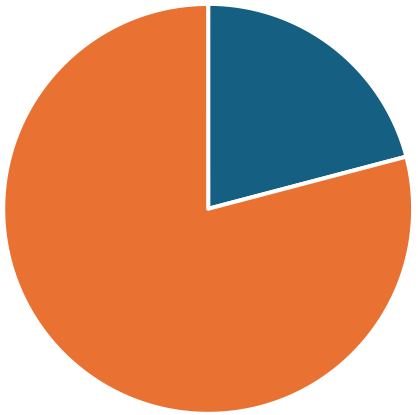
Generalizability – any AMI-CS

BRIEF REPORT

Using Selection Criteria From the DanGer Shock Trial in a Contemporary Cohort With Cardiogenic Shock

Connor G. O'Brien, MD,[a] Samuel B. Brusca, MD,[a] Christopher F. Barnett, MD, MPH,[a] David D. Berg, MD, MPH,[b] Vivian M. Baird-Zars, MPH,[b] Jeong-Gun Park, PhD,[b] Erin A. Bohula, MD, DPhil,[b] David A. Morrow, MD, MPH,[b] the CCCTN Investigators

US – STEMI and NSTEMI



ESC European Society of Cardiology
European Journal of Heart Failure (2021) 23, 1942–1951
doi:10.1002/ejhf.2274

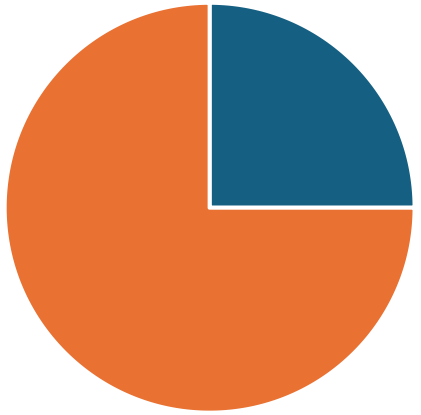
RESEARCH ARTICLE

Eligibility for mechanical circulatory support devices based on current and past randomised cardiogenic shock trials

Benedikt Schrage[1,2,3†], Benedikt N. Beer[1,2†], Gianluigi Savarese[3], Salim Dabboura[1,2], Isabell Yan[1], Jonas Sundermeyer[1,2], Peter M. Becher[1], Hanno Grahn[1], Moritz Seiffert[1], Alexander Bernhardt[4], Holger Thiele[5], Jacob E. Møller[6], Stefan Kluge[7], Hermann Reichenspurner[2,4], Paulus Kirchhof[1,2], Stefan Blankenberg[1,2], and Dirk Westermann[1,2]*

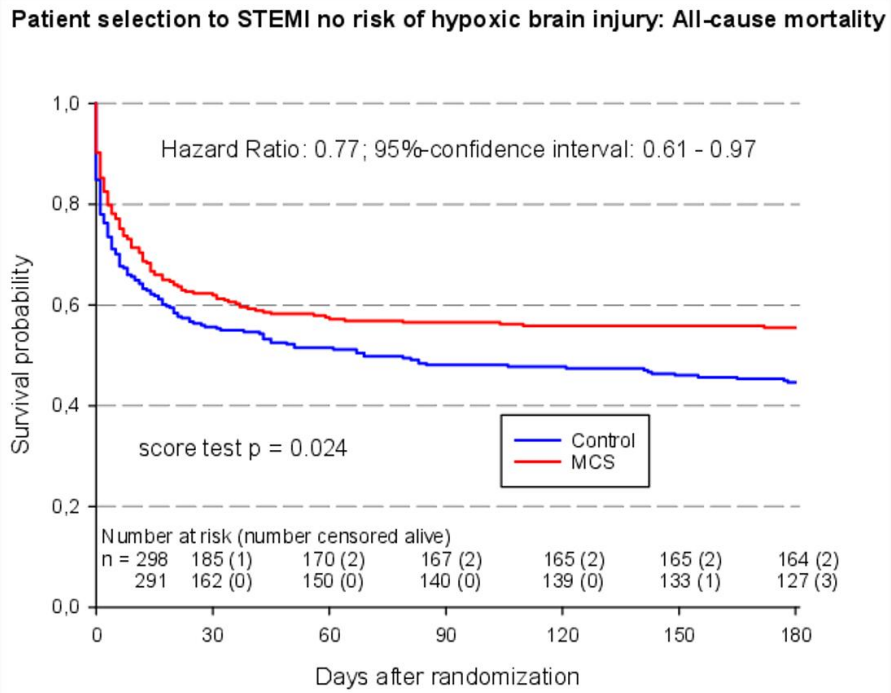
[1]Department of Cardiology, University Heart and Vascular Center Hamburg, Hamburg, Germany; [2]German Centre for Cardiovascular Research (DZHK), Partner Site Hamburg/Lübeck/Kiel, Hamburg, Germany; [3]Department of Medicine, Karolinska Institutet, Stockholm, Sweden; [4]Department of Cardiovascular Surgery, University Heart and Vascular Center Hamburg, Hamburg, Germany; [5]Heart Center Leipzig at University of Leipzig and Leipzig Heart Institute, Leipzig, Germany; [6]Department of Cardiology, University Hospital Odense, Odense, Denmark; and [7]Department of Intensive Care Medicine, University Clinic Hamburg-Eppendorf, Hamburg, Germany

EUROPE – STEMI and NSTEMI



Results

6-Month Mortality – Patient Selection MCS versus no MCS



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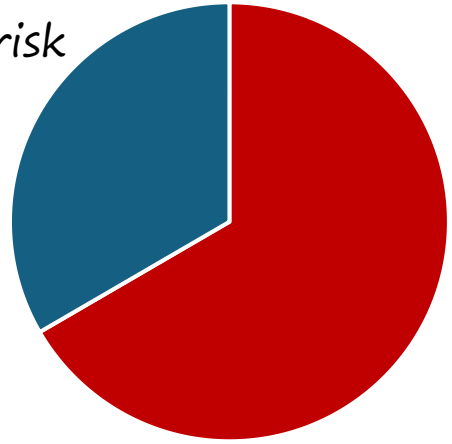
THE LANCET

emporary mechanical circulatory support in infarct-related
rdiogenic shock: an individual patient data meta-analysis
randomised trials with 6-month follow-up

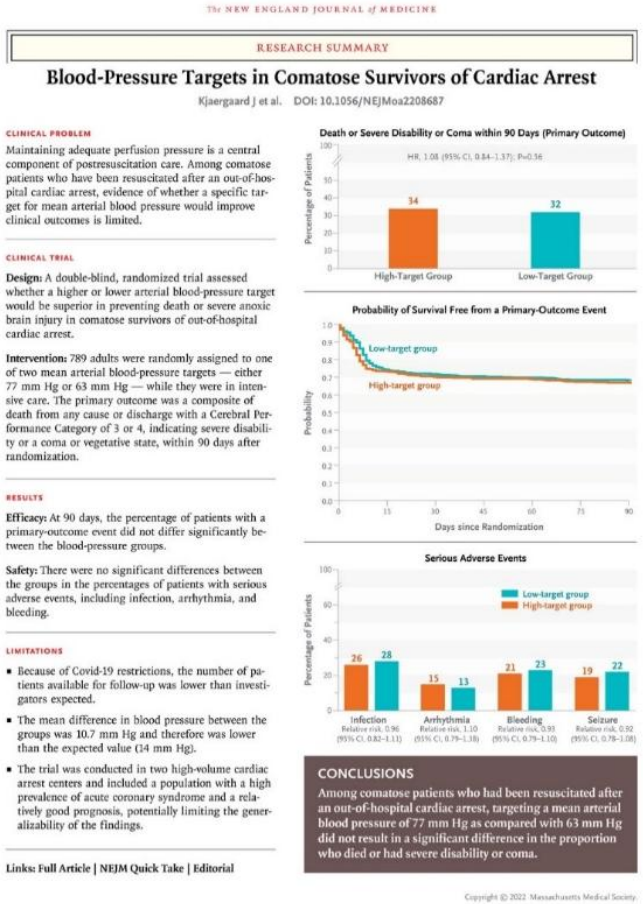
er Thiele*, Jacob E Møller*, Jose P S Henriques, Margriet Bogerd, Melchior Seyfarth, Daniel Burkhoff, Petr Ostadal, Richard Rokyta, Belohlavek, Steffen Massberg, Marcus Flather, Matthias Hochadel, Steffen Schneider, Steffen Desch, Anne Freund, Hans Eiskjær, nan Mangner, Janine Poss, Amin Polzin, P Christian Schulze, Carsten Skurk, Uwe Zeymer†, Christian Hassager†, on behalf of the MCS borator Scientific Group†

STEMI low risk of hypoxic brain injury



AMI-CS and candidate for MCS after shock team evaluation

Most cardiac arrest patients do not need MCS



The NEW ENGLAND JOURNAL of MEDICINE

RESEARCH SUMMARY

Blood-Pressure Targets in Comatose Survivors of Cardiac Arrest

Kjaergaard J et al. DOI: 10.1056/NEJMoa2208687

CLINICAL PROBLEM

Maintaining adequate perfusion pressure is a central component of postresuscitation care. Among comatose patients who have been resuscitated after an out-of-hospital cardiac arrest, evidence of whether a specific target for mean arterial blood pressure would improve clinical outcomes is limited.

CLINICAL TRIAL

Design: A double-blind, randomized trial assessed whether a higher or lower arterial blood-pressure target would be superior in preventing death or severe anoxic brain injury in comatose survivors of out-of-hospital cardiac arrest.

Intervention: 789 adults were randomly assigned to one of two mean arterial blood-pressure targets — either 77 mm Hg or 63 mm Hg — while they were in intensive care. The primary outcome was a composite of death from any cause or discharge with a Cerebral Performance Category of 3 or 4, indicating severe disability or a coma or vegetative state, within 90 days after randomization.

RESULTS

Efficacy: At 90 days, the percentage of patients with a primary-outcome event did not differ significantly between the blood-pressure groups.

Safety: There were no significant differences between the groups in the percentages of patients with serious adverse events, including infection, arrhythmia, and bleeding.

LIMITATIONS

- Because of Covid-19 restrictions, the number of patients available for follow-up was lower than investigators expected.
- The mean difference in blood pressure between the groups was 10.7 mm Hg and therefore was lower than the expected value (14 mm Hg).
- The trial was conducted in two high-volume cardiac arrest centers and included a population with a high prevalence of acute coronary syndrome and a relatively good prognosis, potentially limiting the generalizability of the findings.

Links: Full Article | NEJM Quick Take | Editorial

Death or Severe Disability or Coma within 90 Days (Primary Outcome)

HR, 1.08 (95% CI, 0.84–1.37); P=0.56

Percentage of Patients

34 32

High-Target Group Low-Target Group

Probability of Survival Free from a Primary-Outcome Event

Low-target group

High-target group

Probability

Days since Randomization

Serious Adverse Events

Low-target group

High-target group

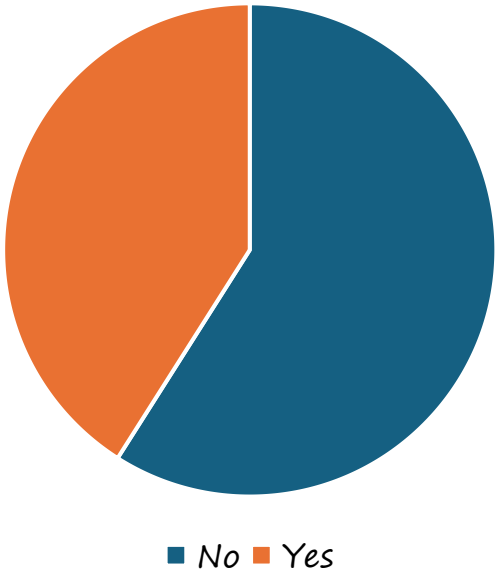
Percentage of Patients

	Infection	Arrhythmia	Bleeding	Seizure
Relative risk, 95% CI	0.96 (0.82–1.11)	1.10 (0.79–1.38)	0.93 (0.79–1.10)	0.92 (0.78–1.08)
High-target group	26	15	21	19
Low-target group	28	13	23	22

CONCLUSIONS

Among comatose patients who had been resuscitated after an out-of-hospital cardiac arrest, targeting a mean arterial blood pressure of 77 mm Hg as compared with 63 mm Hg did not result in a significant difference in the proportion who died or had severe disability or coma.

Eligible for ECLS-SHOCK



1%

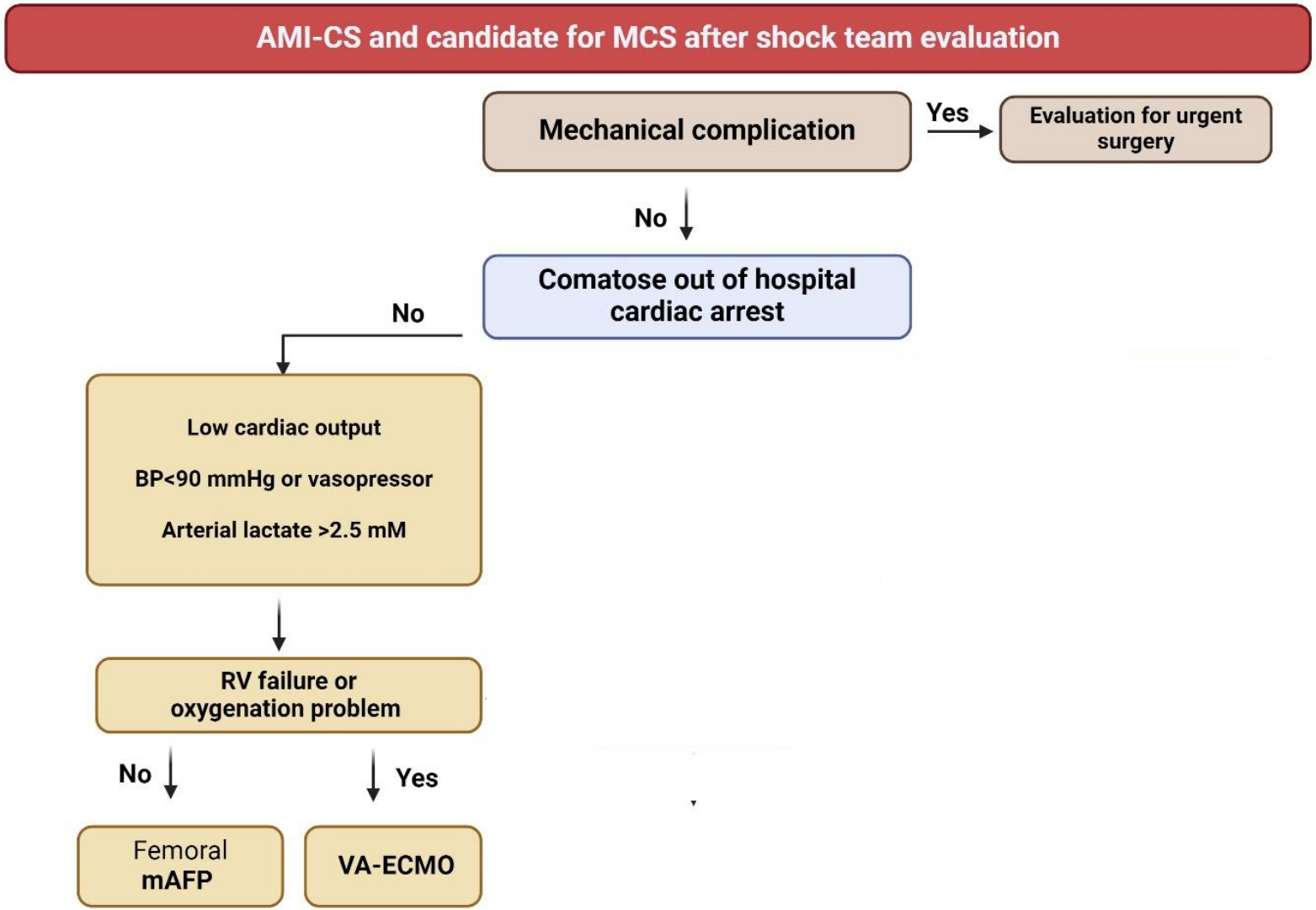
37% at 1-year

BOX trial - 789 resuscitated comatose OHCA patients

Rigshospitalet

Region of Southern Denmark

OUH Odense University Hospital


AMI-CS and candidate for MCS after shock team evaluation
Mechanical complication
Yes
Evaluation for urgent surgery
No
Comatose out of hospital cardiac arrest
No
Low cardiac output
BP<90 mmHg or vasopressor
Arterial lactate >2.5 mM
RV failure or oxygenation problem
No
Yes
Femoral mAFP
VA-ECMO