בשיתוף:
עמותה לקרדיולוגיה בישראל (ע"ר)
ISRAEL CARDIOLOGY ASSOCIATION

החוג לקרדיולוגיה בקהילה
THE ISRAEL WORKING GROUP ON CARDIOLOGY IN THE COMMUNITY

האיגוד הקרדיולוגי בישראל
ISRAEL HEART SOCIETY

# ESC 2023 SUM

## Scientific Update Meeting

22.09.2023 יום שישי, המועצה לישראל יפה

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Jerusalem

# Agenda

1. MULTISTARS AMI trial
2. ECLS-SHOCK trial
3. ARREST trial

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

# Timing of Complete Revascularization with Multivessel PCI for Myocardial Infarction

B.E. Stähli, F. Varbella, A. Linke, B. Schwarz, S.B. Felix, M. Seiffert, R. Kesterke, P. Nordbeck, B. Witzenbichler, I.M. Lang, M. Kessler, C. Valina, A. Dibra, M. Rohla, M. Moccetti, M. Vercellino, L. Gaede, L. Bott-Flügel, P. Jakob, J. Stehli, A. Candreva, C. Templin, M. Schindler, M. Wischnewsky, G. Zanda, G. Quadri, N. Mangner, A. Toma, G. Magnani, P. Clemmensen, T.F. Lüscher, T. Münzel, P.C. Schulze, K.-L. Laugwitz, W. Rottbauer, K. Huber, F.-J. Neumann, S. Schneider, F. Weidinger, S. Achenbach, G. Richardt, A. Kastrati, I. Ford, W. Maier,* and F. Ruschitzka, for the MULTISTARS AMI Investigators†

# Primary Objective

- The primary objective of MULTISTARS AMI was to investigate whether immediate multivessel PCI is non-inferior to staged (within 19 to 45 days) multivessel PCI among hemodynamically stable patients with STEMI and MVD after successful primary PCI of the culprit artery.

- Primary end point: A composite of all-cause death, non-fatal myocardial infarction, stroke, unplanned ischemia-driven revascularization, or hospitalization for heart failure at 1 year.

# Study Power and Follow-up

- Based on an estimated rate of the primary end point of **18%** in both arms
  - a non-inferiority risk ratio of 1.46 and a one-sided significance level of 0.05,
  - a sample size of 800 patients was calculated to rule out the null hypothesis of the inferiority of immediate multivessel PCI compared to a staged procedure.
  - To allow for a 5% drop-out rate, a total of **840 patients** were recruited.
- **Recruitment:** October 2016 to June 2022, 37 sites in Europe.
- **Analysis:** Intention-to-treat, non-inferiority of the primary end point was analyzed using a one-sided Farrington-Manning score test and risk ratio and 95% confidence interval were calculated.
- **Follow-up (vital status):** 97.8% in the immediate PCI group and 97.4% in the staged PCI group.
- **Cross-over:** 2.9% from immediate to staged, 0% from staged to immediate.

# Study Design

**Patients with acute STEMI and MVD after successful PCI of the culprit artery**

MVD was defined as at least one non-culprit coronary artery (≥2.25 mm and ≤5.75 mm) with ≥70% diameter stenosis on coronary angiography

1:1 randomization

**Immediate PCI** (during index procedure) of non-culprit lesions

N=418

**everolimus-eluting stent was recommended*

**Staged PCI** (within 19 to 45 days) of non-culprit lesions

N=422

**Primary end point:** all-cause death, non-fatal myocardial infarction, stroke, ischemia-driven revascularization, or hospitalization for heart failure at 1 year

# Key Exclusion Criteria

- Cardiogenic shock
- Need for emergency coronary artery bypass graft surgery
- Previous coronary artery bypass graft surgery
- Stent thrombosis
- In-stent restenosis
- Chronic total occlusion of a major coronary artery
- Left main disease or left main equivalent with ostial LAD or ostial LCX stenosis
- Any contraindications for dual antiplatelet therapy for at least 90 days (except for patients on oral anticoagulation)

# Baseline Characteristics

| | Immediate PCI (n=418) | Staged PCI (n=422) |
|---|---|---|
| Age, years – median (IQR) | 66 (58-74) | 64 (55-73) |
| Male sex – no. (%) | 321 (76.8) | 341 (80.8) |
| Medical history | | |
| Hypertension – no. (%) | 228 (54.5) | 212 (50.2) |
| Diabetes – no. (%) | 66 (15.8) | 65 (15.4) |
| Dyslipidemia – no. (%) | 112 (26.8) | 114/420 (27.1) |
| Previous PCI – no. (%) | 33/417 (7.9) | 23 (5.5) |
| Previous myocardial infarction – no. (%) | 28 /417 (6.7) | 20/421 (4.8) |
| Previous stroke – no. (%) | 7 (1.7) | 11 (2.6) |
| Family history of CAD – no. (%) | 108/415 (26.0) | 114/421 (27.1) |
| Smoking history | | |
| Former – no. (%) | 78/414 (18.8) | 57/421 (13.5) |
| Current – no. (%) | 140/413 (33.9) | 149/421 (35.4) |
| Presentation | | |
| Resuscitation prior to hospital arrival – no. (%) | 14 (3.3) | 18 (4.3) |
| Left bundle branch block – no. (%) | 5/411 (1.2) | 6/414 (1.4) |

# Procedural Characteristics

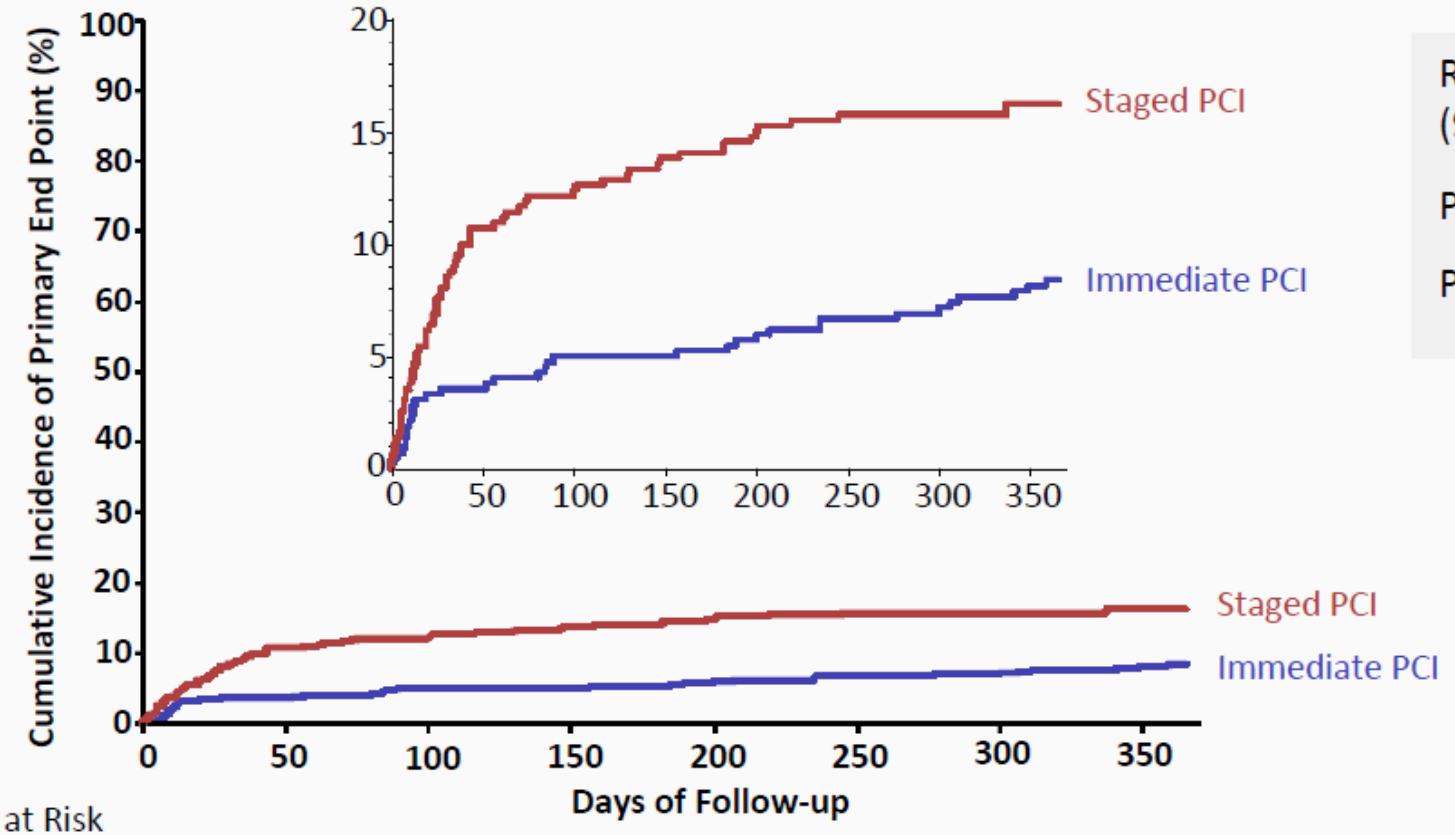
| | Immediate PCI (n=418) | Staged PCI (n=422) |
|---|---|---|
| Location of culprit lesions – no. (%) | | |
| Left main | - | 1 (0.2) |
| Left anterior descending coronary artery | 163 (39.0) | 176 (41.7) |
| Left circumflex coronary artery | 67 (16.0) | 77 (18.2) |
| Right coronary artery | 188 (45.0) | 169 (40.0) |
| Number of vessels with significant non-culprit lesions – no. (%) | | |
| 1 | 316/380 (83.2) | 275/342 (80.4) |
| ≥2 | 64/380 (16.8) | 67/342 (19.6) |
| Access site for index procedure – no. (%) | | |
| Radial | 301/418 (72.0) | 311/422 (73.7) |
| Femoral | 117/418 (28.0) | 111/422 (26.3) |
| Access site for staged procedure – no. (%) | | |
| Radial | - | 296/386 (76.7) |
| Femoral | - | 90/386 (23.3) |
| Hospital stay, days – median (IQR) | | |
| Index procedure | 4 (3-6), n=410 | 4 (3-6), n=408 |
| Index plus staged procedures | - | 5 (4-7), n=370 |
| Time to staged procedure, days – median (IQR) | - | 37 (30-43), n=386 |

# Procedural Characteristics

| | Immediate PCI (n=418) | Staged PCI (n=422) |
|---|---|---|
| Peri-procedural antiplatelet drugs – no. (%) | | |
| Clopidogrel | 41/417 (9.8) | 25/422 (5.9) |
| Ticagrelor | 150/418 (35.9) | 167/422 (39.6) |
| Prasugrel | 169/418 (40.4) | 178/422 (42.2) |
| GP IIb/IIIa inhibitor | 42/418 (10.0) | 39/422 (9.2) |
| Fractional flow reserve – no. (%) | 12/418 (2.9) | 36/386 (9.3) |
| Intravascular ultrasound – no. (%) | 8/418 (1.9) | 8/386 (2.1) |
| Optical coherence tomography – no. (%) | 2/418 (0.5) | 7/386 (1.8) |
| Contrast use, ml – median (IQR) | | |
| Index procedure | 250 (199-320), n=415 | 170 (130-220), n=419 |
| Index plus staged procedures | - | 333 (258-411), n=380 |
| Fluoroscopy time, min – median (IQR) | | |
| Index procedure | 18 (13-25), n=410 | 10 (7-16), n=415 |
| Index plus staged procedures | - | 24 (16-34), n=372 |
| Procedure duration, min – median (IQR) | | |
| Index procedure | 73 (58-93), n=416 | 52 (40-69), n=421 |
| Index plus staged procedures | - | 105 (80-138), n=380 |

# Primary Outcome

Composite of all-cause death, non-fatal myocardial infarction, stroke, unplanned ischemia-driven revascularization, or hospitalization for heart failure at 1 year




Risk ratio 0.52
(95% CI 0.38 to 0.72)

$P_{non\text{-}inferiority} < 0.0001$

$P_{superiority} = 0.0004$

| Number at Risk | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Staged group | 422 | 376 | 366 | 360 | 354 | 351 | 350 | 345 |
| Immediate group | 418 | 403 | 397 | 396 | 392 | 390 | 387 | 369 |

# Primary and Secondary Outcomes

| | Immediate PCI (n=418) no. (%) | Staged PCI (n=422) no. (%) | Treatment effect |
|---|---|---|---|
| **Primary end point** | | | |
| Death, non-fatal myocardial infarction, stroke, unplanned ischemia-driven revascularization, or hospitalization for heart failure | 35 (8.5) | 68 (16.3) | 0.52 (0.38 to 0.72) |
| **Secondary end points at 1 year** | | | |
| Death | 12 (2.9) | 11 (2.6) | 1.10 (0.48 to 2.48) |
| Non-fatal myocardial infarction | 8 (2.0) | 22 (5.3) | 0.36 (0.16 to 0.80) |
| Stroke | 5 (1.2) | 7 (1.7) | 0.72 (0.23 to 2.26) |
| Unplanned ischemia-driven revascularization | 17 (4.1) | 39 (9.3) | 0.42 (0.24 to 0.74) |
| Hospitalization for heart failure | 5 (1.2) | 6 (1.4) | 0.84 (0.26 to 2.74) |
| Death or non-fatal myocardial infarction | 19 (4.6) | 32 (7.7) | 0.58 (0.33 to 1.03) |
| Cardiac death | 5 (1.2) | 6 (1.4) | 0.84 (0.26 to 2.74) |
| Target vessel revascularization | 10 (2.4) | 12 (2.9) | 0.83 (0.36 to 1.93) |
| Target lesion revascularization | 9 (2.2) | 12 (2.9) | 0.75 (0.32 to 1.78) |
| Stent thrombosis | 5 (1.2) | 6 (1.4) | 0.84 (0.26 to 2.75) |
| Acute kidney failure | 15 (3.6) | 13 (2.9) | 1.26 (0.59 to 2.70) |
| Major bleeding (BARC 3 or 5) | 13 (3.1) | 21 (4.8) | 0.65 (0.32 to 1.31) |
| Procedural success | 347/383 (90.6) | 308/338 (91.1) | 0.94 (0.56 to 1.56) |
| Quality of life (EQ-5D-5L index) | 1.0 (0.9-1.0) | 1.0 (0.9-1.0) | 1.02 (0.91 to 1.12) |

# Conclusions

The MULTISTARS AMI trial demonstrates that in patients with STEMI and MVD immediate multivessel PCI is non-inferior to staged multivessel PCI based on the 1-year risk for the composite of all-cause death, non-fatal myocardial infarction, stroke, unplanned ischemia-driven revascularization, or hospitalization for heart failure.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

# Extracorporeal Life Support in Infarct-Related Cardiogenic Shock

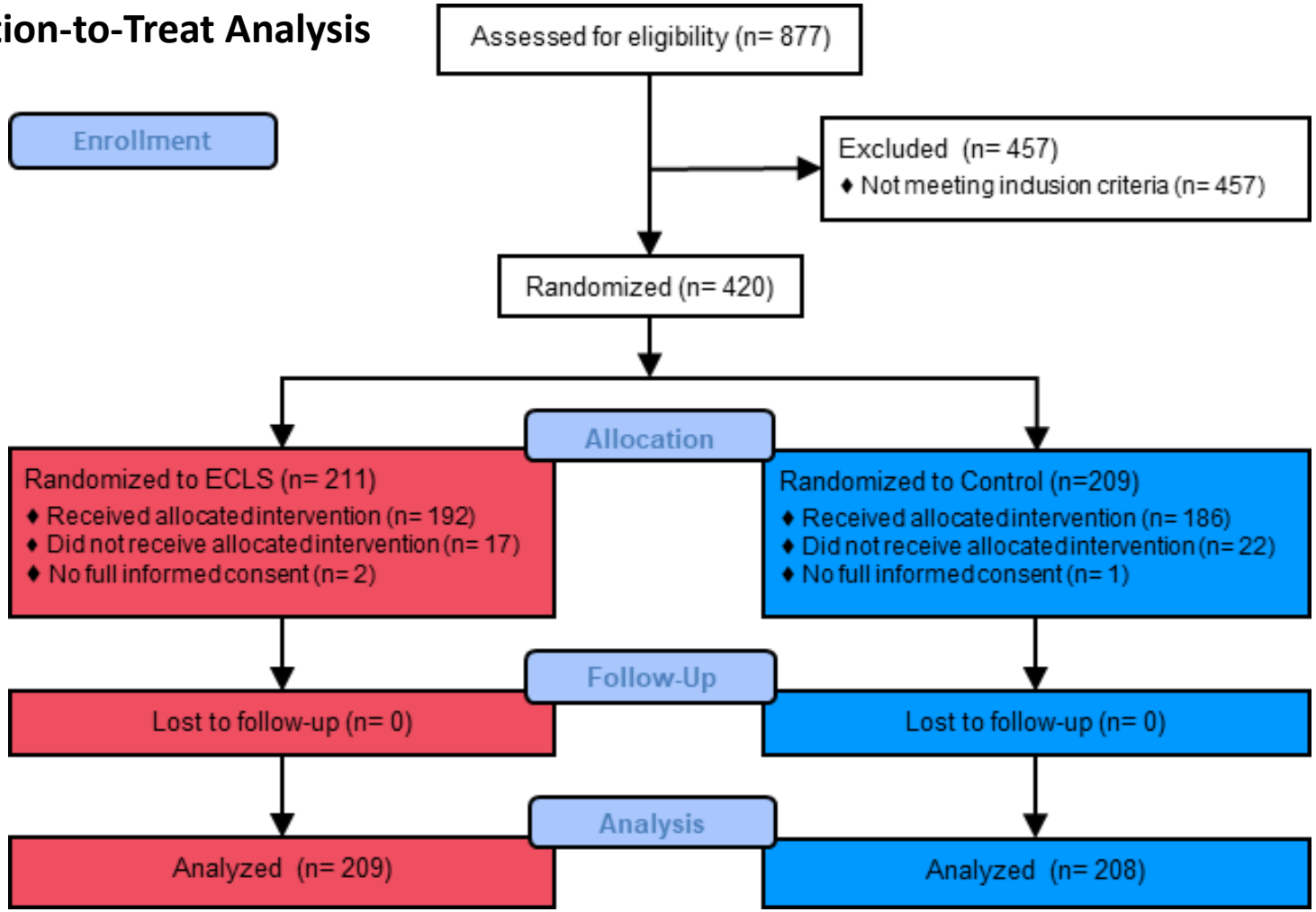
H. Thiele, U. Zeymer, I. Akin, M. Behnes, T. Rassaf, A.A. Mahabadi, R. Lehmann, I. Eitel, T. Graf, T. Seidler, A. Schuster, C. Skurk, D. Duerschmied, P. Clemmensen, M. Hennersdorf, S. Fichtlscherer, I. Voigt, M. Seyfarth, S. John, S. Ewen, A. Linke, E. Tigges, P. Nordbeck, L. Bruch, C. Jung, J. Franz, P. Lauten, T. Goslar, H.-J. Feistritzer, J. Pöss, E. Kirchhof, T. Ouarrak, S. Schneider, S. Desch, and A. Freund, for the ECLS-SHOCK Investigators*

# Trial flow

## Methods

44 study sites


**Intention-to-Treat Analysis**



# Study design

Thiele et al. Am Heart J 2021;234: 1-1

**Methods**

| Inclusion Criteria | Exclusion Criteria |
|---|---|
| • Cardiogenic shock complicating AMI (STEMI or NSTEMI) plus obligatory:<br>1. Planned **revascularization**<br>2. **SBP <90** mmHg >30 min or **catecholamines** required to maintain SBP >90 mmHg<br>3. Signs of **impaired** organ **perfusion** with at least one of the following criteria:<br>➢ Altered mental status<br>➢ Cold, clammy skin and extremities<br>➢ Oliguria with urine output <30 ml/h<br>4. Arterial **lactate** >3 mmol/l<br>• Informed **consent** | • Resuscitation >45 minutes<br>• Mechanical cause of cardiogenic shock<br>• Onset of shock >12 h<br>• Severe peripheral artery disease with impossibility to insert ECLS cannulae<br>• Age <18 years or >80 years<br>• Shock of other cause (bradycardia, sepsis, hypovolemia, etc.)<br>• Other severe concomitant disease with limited life expectancy <6 months<br>• Pregnancy<br>• Participation in another trial |

# Study design

## Primary endpoint - 30-day all-cause mortality

**Methods**

**Secondary endpoints**

Time to hemodynamic stabilization
Duration of catecholamine therapy
Serial creatinine-level and creatinine-clearance until hemodynamic stabilization
Mean and area under the curve of arterial lactate during 48 hours after PCI
Peak release of myocardial enzymes
Serial SAPS II
Length of mechanical ventilation
Length of ICU stay
Length of hospital stay
Acute renal failure requiring renal replacement therapy within 30 days
Recurrent myocardial infarction within 30 days
Need for repeat revascularization (PCI and/or CABG) within 30-days
Rehospitalization for heart failure within 30 days
Cerebral performance category (CPC) at 30 days

## Safety outcomes

- **Bleeding (moderate-severe)**
- **Stroke**
- Peripheral **vascular complication** warranting intervention

Thiele et al. Am Heart J 2021;234: 1-1

# Baseline Characteristics

Results

Table 1. Characteristics of the Patients at Baseline.*

| Characteristic | ECLS (N = 209) | Control (N = 208) |
|---|---|---|
| Median age (IQR) — yr | 62 (56–69) | 63 (57–71) |
| Male sex — no. (%) | 170 (81.3) | 169 (81.2) |
| Median body-mass index (IQR)† | 27 (25–30) | 28 (25–31) |
| Cardiovascular risk factors — no./total no. (%) | | |
| Current smoking | 74/204 (36.3) | 71/206 (34.5) |
| Hypertension | 118/207 (57.0) | 115/206 (55.8) |
| Hypercholesterolemia | 55/207 (26.6) | 74/206 (35.9) |
| Diabetes mellitus | 70/208 (33.7) | 60/206 (29.1) |
| Cardiovascular history — no./total no. (%) | | |
| Myocardial infarction | 23/208 (11.1) | 31/206 (15.0) |
| PCI | 27/208 (13.0) | 43/206 (20.9) |
| CABG | 5/208 (2.4) | 6/207 (2.9) |
| Stroke | 20/208 (9.6) | 11/207 (5.3) |
| Peripheral-artery disease | 21/208 (10.1) | 16/206 (7.8) |

**No significant difference in CV risk factors**

Results

| | ECLS (N = 209) | Control (N = 208) |
|---|---|---|
| Signs of impaired organ perfusion — no.(%) | | |
| Altered mental status | 200 (95.7) | 198 (95.2) |
| Cold, clammy skin and limbs | 202 (96.7) | 204 (98.1) |
| Oliguria | 150 (71.8) | 150 (72.1) |
| Median blood pressure (IQR) — mm Hg | | |
| Systolic | 95 (80–120) | 97 (80–120) |
| Diastolic | 61 (50–73) | 60 (50–71) |
| Median heart rate (IQR) — beats/min | 90 (75–110) | 95 (71–110) |
| ST-segment elevation myocardial infarction — no./total no. (%) | 135/204 (66.2) | 141/207 (68.1) |
| Fibrinolysis <24 hr before randomization — no./total no. (%) | 6/208 (2.9) | 9/208 (4.3) |
| Resuscitation before randomization — no. (%) | 162 (77.5) | 162 (77.9) |
| Median time until return of spontaneous circulation during longest continuous resuscitation (IQR) — min | 20 (10–25) | 20 (12–28) |
| No. of diseased vessels — no./total no. (%) | | |
| 1 | 71/203 (35.0) | 63/200 (31.5) |
| 2 | 71/203 (35.0) | 53/200 (26.5) |
| 3 | 61/203 (30.0) | 84/200 (42.0) |
| Infarct-related artery — no./total no. (%) | | |
| Left anterior descending | 95/203 (46.8) | 97/200 (48.5) |
| Left circumflex | 36/203 (17.7) | 35/200 (17.5) |
| Right coronary | 52/203 (25.6) | 48/200 (24.0) |
| Left main | 20/203 (9.9) | 20/200 (10.0) |

**Mostly STEMI, post-CPR, with TVD while LAD was the most common artery involved**

# Baseline Characteristics

Results

| | ECLS (N = 209) | Control (N = 208) |
|---|---|---|
| Median left ventricular ejection fraction (IQR) — % | 30 (20–35) | 30 (20–40) |
| Laboratory values on admission | | |
| Median pH (IQR) | 7.2 (7.1–7.3) | 7.2 (7.1–7.3) |
| Median lactate (IQR) — mmol/liter | 6.8 (4.5–9.6) | 6.9 (4.6–10.0) |
| Median creatinine (IQR) — mg/dl | 1.2 (1.0–1.5) | 1.3 (1.1–1.6) |
| Median high-sensitivity cardiac troponin T (IQR) — ng/liter | 1540 (232–6630) | 987 (173–5700) |

| Characteristic | ECLS (N = 209) | Control (N = 208) |
|---|---|---|
| SCAI shock stage — no. (%)‡ | | |
| C | 104 (49.8) | 111 (53.4) |
| D | 38 (18.2) | 18 (8.7) |
| E | 67 (32.1) | 79 (38.0) |

# Treatment Characteristics

Results

**Table 2. Treatment.***

| Characteristic | ECLS (N = 209) | Control (N = 208) |
|---|---|---|
| Catheterization access — no./total no. (%) | | |
| Femoral | 156/208 (75.0) | 148/207 (71.5) |
| Radial | 52/208 (25.0) | 59/207 (28.5) |
| Type of revascularization — no./total no. (%) | | |
| PCI | 199/208 (95.7) | 199/204 (97.5) |
| CABG | 1/208 (0.5) | 0/204 |
| PCI with transfer to CABG | 2/208 (1.0) | 0/204 |
| No revascularization | 6/208 (2.9) | 5/204 (2.5) |
| TIMI grade for blood flow of culprit lesion — no./total no. (%) | | |
| Before revascularization | | |
| 0 | 96/202 (47.5) | 105/197 (53.3) |
| I | 41/202 (20.3) | 33/197 (16.8) |
| II | 40/202 (19.8) | 40/197 (20.3) |
| III | 25/202 (12.4) | 19/197 (9.6) |

Results

| | ECLS (N=209) | Control (N=208) |
|---|---|---|
| After revascularization | | |
| 0 | 2/192 (1.0) | 0/189 |
| I | 6/192 (3.1) | 0/189 |
| II | 10/192 (5.2) | 12/189 (6.3) |
| III | 174/192 (90.6) | 177/189 (93.7) |
| Immediate PCI of nonculprit lesions — no./total no. (%) | 50/203 (24.6) | 42/200 (21.0) |
| ECLS therapy — no. (%) | 192 (91.9) | 26 (12.5) |
| Initiation in catheterization laboratory | | |
| Before revascularization | 42/192 (21.9) | 4/26 (15.4) |
| During revascularization | 50/192 (26.0) | 8/26 (30.8) |
| After revascularization | 100/192 (52.1) | 7/26 (26.9) |
| Initiation after catheterization laboratory | | |
| <24 hr | 0/192 | 3/26 (11.5) |
| ≥24 hr | 0/192 | 4/26 (15.4) |
| Median duration of ECLS therapy (IQR) — days | 2.7 (1.5–4.8) | 2.7 (2.2–3.8) |
| Peripheral antegrade perfusion sheath during ECLS therapy — no./total no. (%) | 183/192 (95.3) | 16/19 (84.2) |
| Median diameter of arterial cannula (IQR) — French size | 17 (15–18) | 17 (15–17) |

Cross-over between groups

# Treatment Characteristics

Results

| | ECLS (N=209) | Control (N=208) |
|---|---|---|
| Active left ventricular unloading during ECLS therapy — no./total no. (%) | 11/191 (5.8) | 6/19 (31.6) |
| Other mechanical circulatory support in patients without ECLS — no./total no. (%) | 0/17 | 28/182 (15.4) |
| Intraaortic balloon pump | — | 1/28 (3.6) |
| Impella 2.5 | — | 1/28 (3.6) |
| Impella CP | — | 24/28 (85.7) |
| Impella 5.0 | — | 1/28 (3.6) |
| Impella 5.5 | — | 1/28 (3.6) |
| Permanent left ventricular assist device — no./total no. (%) | 1 (0.5) | 1 (0.5) |

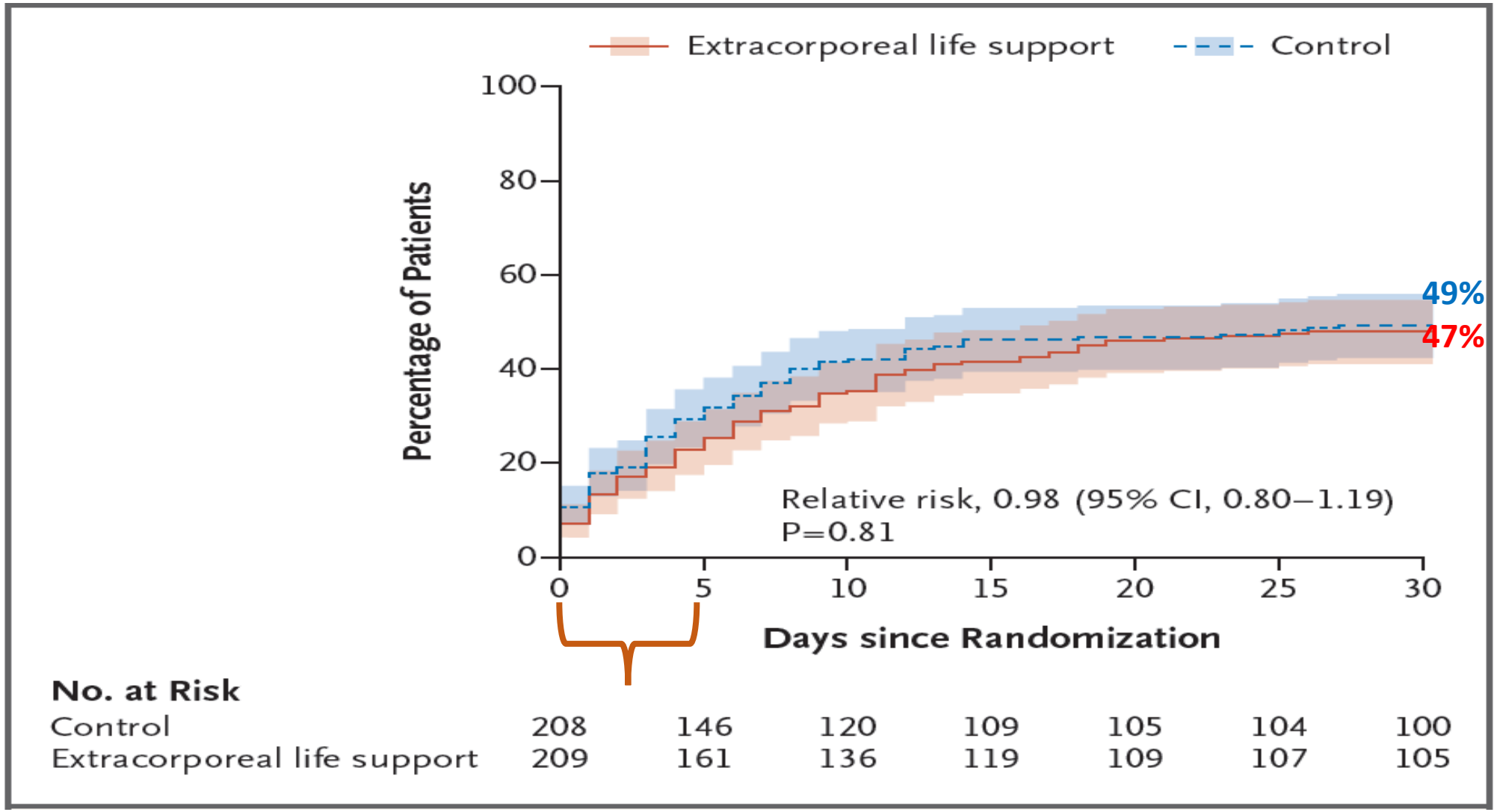
# Treatment Characteristics

Results

| Characteristic | ECLS (N = 209) | Control (N = 208) |
|---|---|---|
| Target temperature management — no./total no. (%) | 82/209 (39.2) | 109/208 (52.4) |
| Invasive mechanical ventilation | | |
| Patients — no./total no. (%) | 183/203 (90.1) | 177/202 (87.6) |
| Median duration (IQR) — days | 7.0 (4.0–12.0) | 5.0 (3.0–9.0) |
| Catecholamine requirement — no./total no. (%) | 203/209 (97.1) | 195/208 (93.8) |
| Norepinephrine | 181/203 (89.2) | 181/195 (92.8) |
| Epinephrine | 63/203 (31.0) | 69/195 (35.4) |
| Dobutamine | 88/203 (43.3) | 59/195 (30.3) |
| Dopamine | 1/203 (0.5) | 0/195 |
| Sepsis within 30 days after randomization — no. (%) | 21 (10.0) | 21 (10.1) |

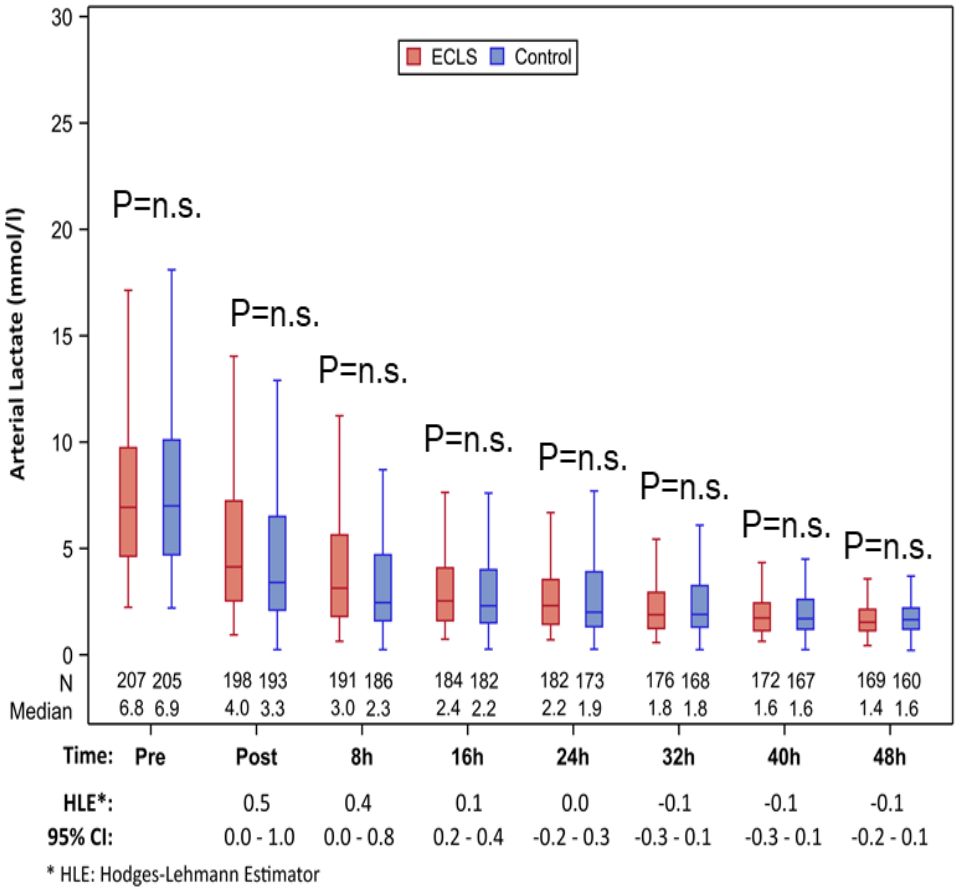
# Primary end point

Results



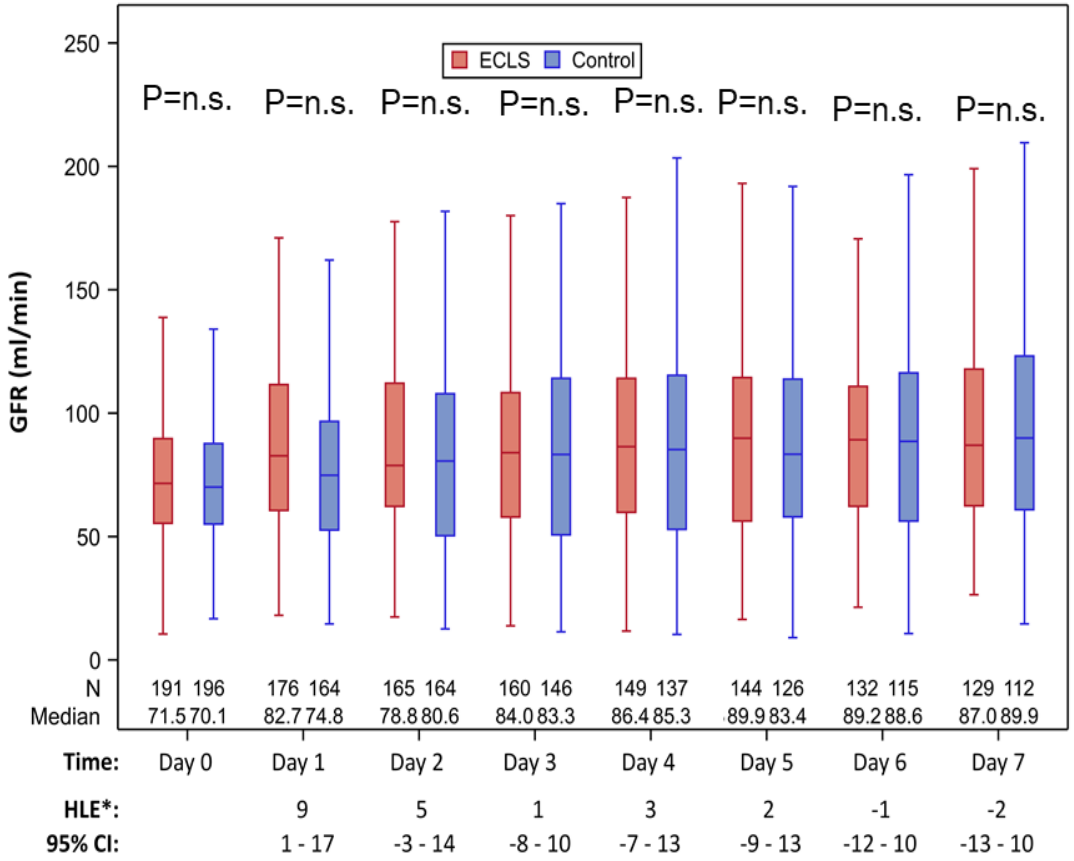
# Secondary end points

## Arterial Lactate




* HLE: Hodges-Lehmann Estimator

## Renal Function - eGFR




* HLE: Hodges-Lehmann Estimator

# Secondary end points

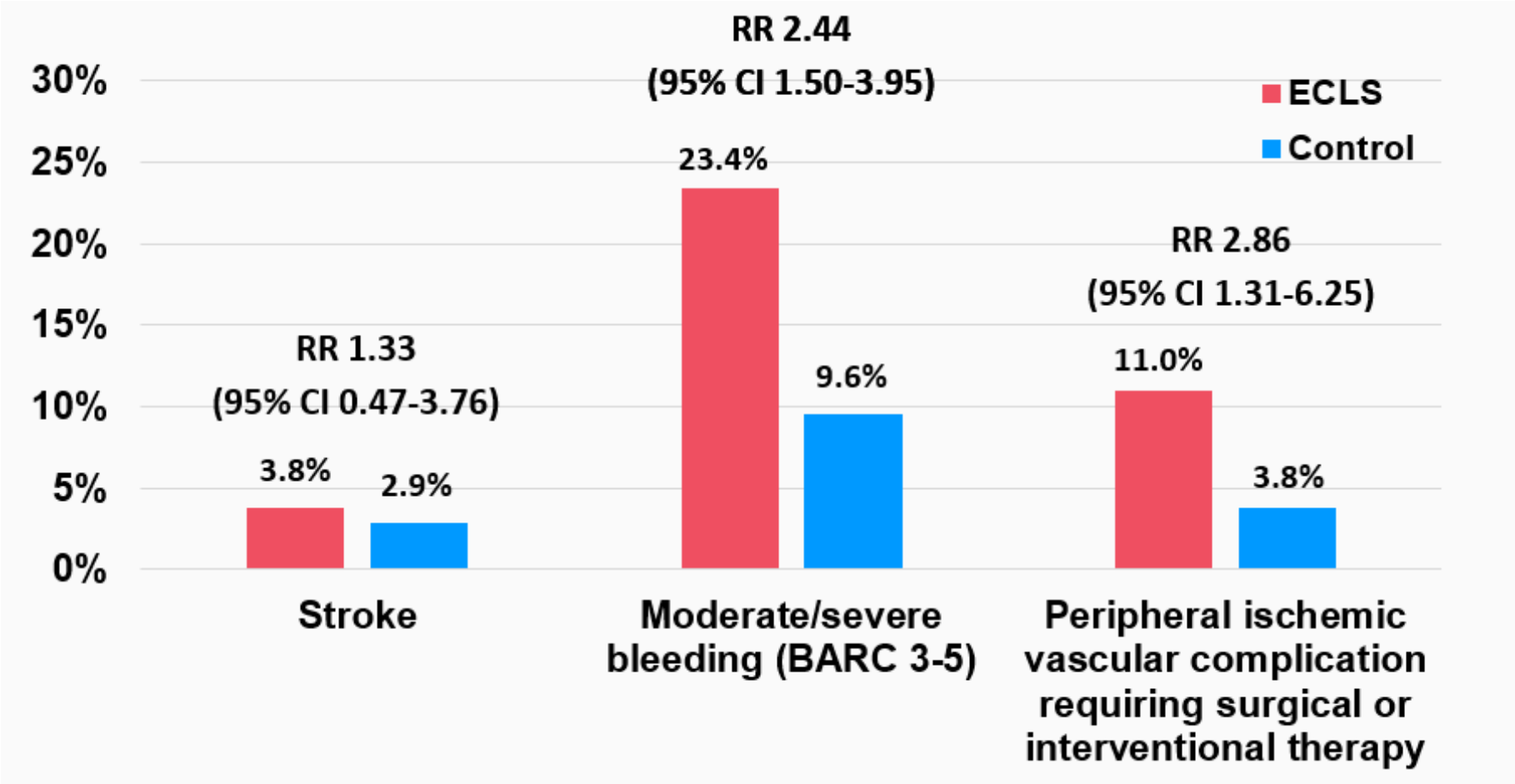
Results

Table 3. Clinical Outcomes at 30 Days.

| | ECLS (N=209) | Control (N=208) | Effect Size (95% CI)* |
|---|---|---|---|
| **Secondary outcomes** | | | |
| Renal-replacement therapy — no. (%) | 17 (8.1) | 29 (13.9) | Relative risk, 0.58 (0.33 to 1.03) |
| Repeat revascularization — no. (%) | 18 (8.6) | 22 (10.6) | Relative risk, 0.81 (0.45 to 1.47) |
| Myocardial reinfarction — no. (%) | 2 (1.0) | 2 (1.0) | Relative risk, 1.00 (0.07 to 12.72)† |
| Rehospitalization for congestive heart failure — no. (%) | 3 (1.4) | 2 (1.0) | Relative risk, 1.49 (0.24 to 13.61)† |
| Poor neurologic outcome, CPC 3 or 4 — no./total no. (%)‡ | 27/109 (24.8) | 24/106 (22.6) | Relative risk, 1.03 (0.88 to 1.19) |
| Median duration of invasive mechanical ventilation (IQR) — days | 7.0 (4.0 to 12.0) | 5.0 (3.0 to 9.0) | HLE, 1 (0 to 2) |
| Median time until hemodynamic stabilization (IQR) — days | 3.1 (1.2 to 6.6) | 3.1 (1.2 to 5.4) | HLE, 0.27 (–0.41 to 1.14) |
| Median duration of catecholamine therapy (IQR) — days | 5.0 (2.5 to 8.0) | 4.0 (2.0 to 7.0) | HLE, 1 (0 to 1) |
| Median duration of intensive care treatment (IQR) — days | 10.0 (4.0 to 16.0) | 8.0 (4.0 to 13.0) | HLE, 1 (0 to 3) |
| Median duration of hospital stay (IQR) — days | 12.0 (5.0 to 20.0) | 10.0 (3.0 to 19.0) | HLE, 2 (0 to 4) |

# Safety

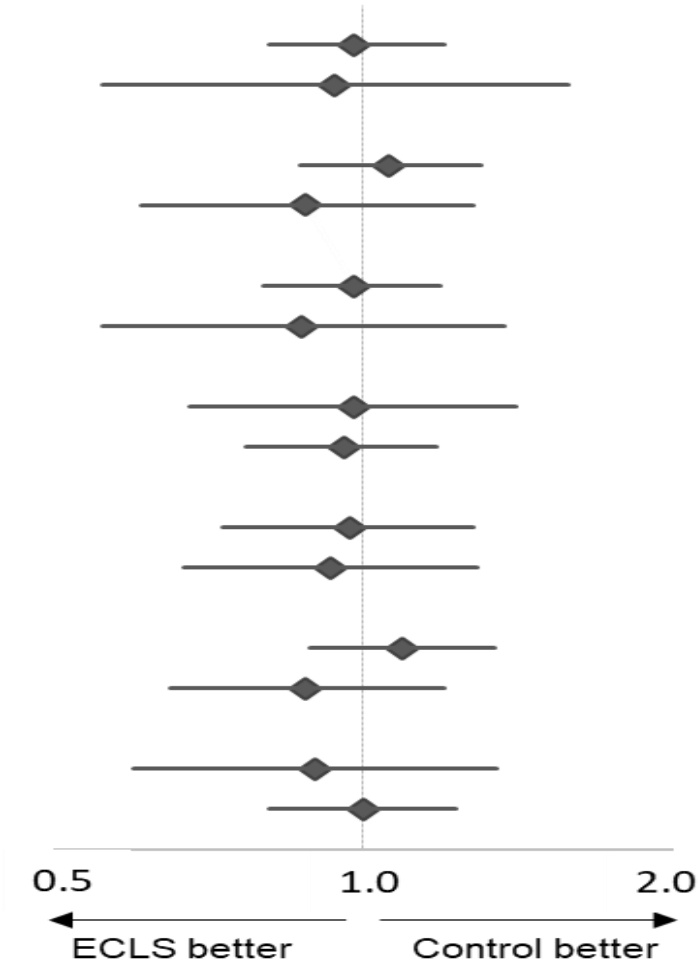
Results



# 30-Day All-Cause Mortality - Subgroups

Results

| | 30-day all-cause mortality (%) Control<br>No. of patients with event/total no. of patients (%) | ECLS | Relative Risk (95%) |
|---|---|---|---|
| **Sex** | | | |
| Male | 79/169 (46.7) | 78/170 (45.9) | 0.98 (0.81-1.20) |
| Female | 23/39 (59.0) | 22/39 (56.4) | 0.94 (0.56-1.58) |
| **Age** | | | |
| <65 years | 41/112 (36.6) | 50/124 (40.3) | 1.06 (0.87-1.30) |
| >= 65 years | 61/96 (63.5) | 50/85 (58.8) | 0.88 (0.61-1.28) |
| **Diabetes** | | | |
| No | 62/146 (42.5) | 57/138 (41.3) | 0.98 (0.80-1.19) |
| Yes | 39/60 (65.0) | 42/70 (60.0) | 0.87 (0.56-1.37) |
| **Type of infarction** | | | |
| NSTEMI | 36/66 (54.5) | 37/69 (53.6) | 0.98 (0.68-1.41) |
| STEMI | 65/141 (46.1) | 59/135 (43.7) | 0.96 (0.77-1.18) |
| **STEMI type** | | | |
| Anterior infarction | 39/85 (45.9) | 33/75 (44.0) | 0.97 (0.73-1.28) |
| Non-anterior infarction | 26/56 (46.4) | 25/59 (42.4) | 0.93 (0.67-1.29) |
| **Arterial lactate** | | | |
| <= 6 mmol/l | 24/85 (28.2) | 30/87 (34.5) | 1.09 (0.89-1.34) |
| > 6 mmol/l | 75/120 (62.5) | 69/120 (57.5) | 0.88 (0.65-1.20) |
| **CPR** | | | |
| No | 24/46 (52.2) | 22/47 (46.8) | 0.90 (0.60-1.35) |
| Yes | 78/162 (48.2) | 78/162 (48.2) | 1.00 (0.81-1.23) |



# Summary

- In AMI and CS with planned revascularization **routine** VA-ECMO versus control **does not reduce 30-day all-cause mortality**

- Higher rates of moderate or severe BARC **bleeding** and peripheral ischemic **complications** requiring intervention

# Study limitations & Questions

- Open label trial
- Patient selection – post CPR – too sick? Lactate from CPR?
- Cross-over between groups and MCS in the control group (26%) – intention to treat analysis
- Low rates of LV unloading in ECLS group
- High rate of dobutamine use among ECLS group
- Longer hospitalization + mechanical ventilation – could alter results?
- What about those developing late CS – 6-24h?

# Expedited transfer to a cardiac arrest centre for non-ST-elevation out-of-hospital cardiac arrest (ARREST): a UK prospective, multicentre, parallel, randomised clinical trial

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# Aim

- We aimed to determine if delivery direct to cardiac catheter lab in a cardiac arrest centre following non-ST elevation out-of-hospital cardiac arrest (OHCA) arrest reduces deaths compared with delivery to the nearest emergency department

# Methods

- **Trial Conduct**
  - London Ambulance Service
  - 24 hours a day, 7 days per week
- **All acute London hospitals**
  - 32 emergency departments
  - 7 designated “cardiac arrest centres”
- **Enrolment**
  - London Ambulance Service paramedics
  - Pre-hospital following resuscitated OHCA
  - Patients randomised 1:1
    - Cardiac catheter lab in cardiac arrest centre
    - Nearest emergency department

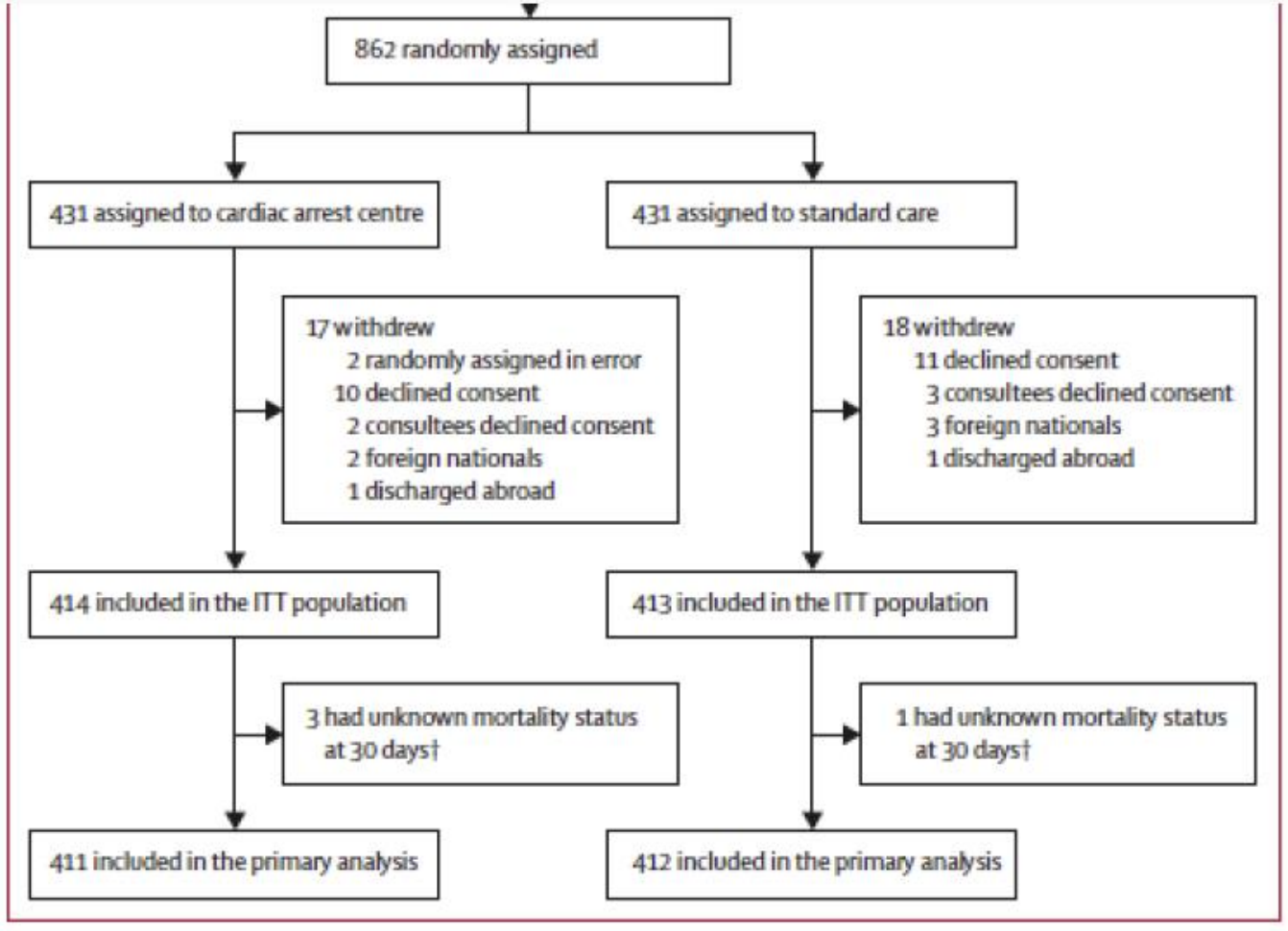
# Inclusion and Exclusion Criteria

- **Inclusion:**
  - Adult patients with resuscitated cardiac arrest
- **Exclusion:**
  - ST-elevation myocardial infarction
  - Presumed non-cardiac cause
  - Pregnancy
  - Do not attempt resuscitation order

# Endpoints and Outcomes

- **Primary endpoint:**
  - 30 day all cause mortality
- **Secondary endpoints:**
  - 3-month all cause mortality
  - Neurological outcome at discharge and 3 months
  - EQ 5D 5L score (quality of life outcome)

# Enrolment




- Randomisation from Jan 15, 2018 to Dec 1, 2022

# Patient characteristics

| | Cardiac arrest centre group (n=414) | Standard care group (n=413) |
|---|---|---|
| Age, years | 63·8 (16) | 63·2 (16) |
| Sex | | |
| Male | 285/412 (69%) | 275/410 (67%) |
| Female | 127/412 (31%) | 135/410 (33%) |
| Ethnicity | | |
| White | 224/414 (54%) | 224/413 (54%) |
| Asian | 69/414 (17%) | 69/413 (17%) |
| Afro-Caribbean | 21/414 (5%) | 25/413 (6%) |
| Other | 39/414 (9%) | 45/413 (11%) |
| Not known | 61/414 (15%) | 50/413 (12%) |
| Medical history | | |
| Diabetes | 98/385 (26%) | 90/376 (24%) |
| Hypertension | 182/376 (48%) | 190/372 (51%) |
| Smoking status | | |
| Never smoked | 96/414 (23%) | 83/413 (20%) |
| Ex-smoker | 50/414 (12%) | 53/413 (13%) |
| Current smoker | 41/414 (10%) | 55/413 (13%) |

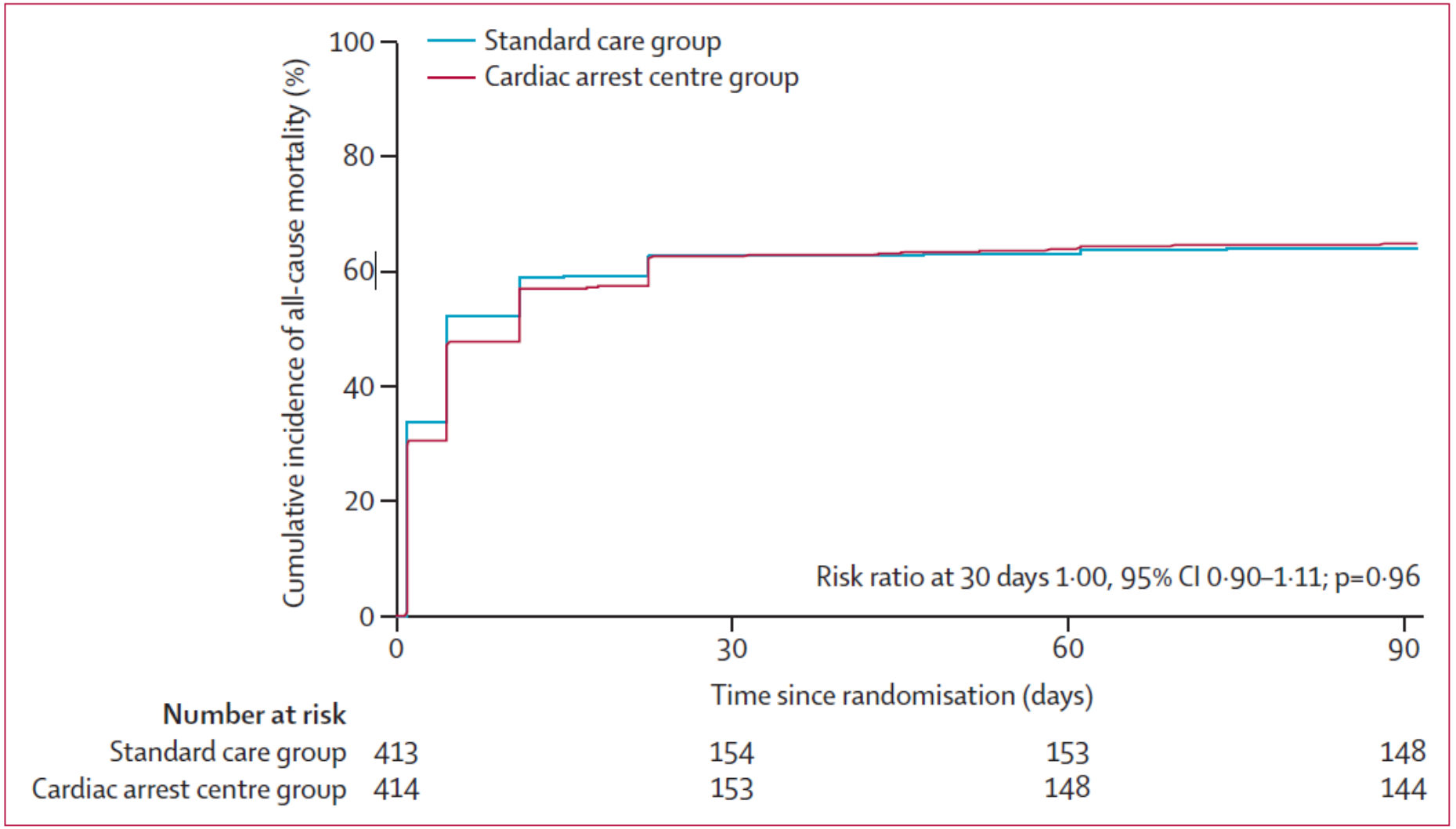
| | Cardiac arrest centre group (n=414) | Standard care group (n=413) |
|---|---|---|
| Hypercholesterolaemia | 99/342 (29%) | 83/315 (26%) |
| Peripheral vascular disease | 12/360 (3%) | 13/348 (4%) |
| Cerebrovascular disease | 26/369 (7%) | 39/362 (11%) |
| Chronic renal failure | 33/375 (9%) | 31/362 (9%) |
| Known ischaemic heart disease | 83/362 (23%) | 63/353 (18%) |
| Previous myocardial infarction | 54/364 (15%) | 48/362 (13%) |
| Previous percutaneous coronary intervention | 46/362 (13%) | 34/349 (10%) |
| Family history of heart disease | 32/179 (18%) | 32/168 (19%) |
| Preceding symptoms before cardiac arrest | 122/267 (46%) | 142/260 (55%) |
| Chest pain | 29/122 (24%) | 43/142 (30%) |
| Dizziness | 11/122 (9%) | 29/142 (20%) |
| Breathlessness | 50/122 (41%) | 49/142 (35%) |
| Palpitations | 2/122 (2%) | 8/142 (6%) |
| Other symptoms | 61/122 (50%) | 74/142 (52%) |

# Cardiac Arrest Characteristics

| | Cardiac arrest centre group (n=414) | Standard care group (n=413) |
|---|---|---|
| Location of arrest | | |
| Private | 208 (50%) | 242 (59%) |
| Public | 206 (50%) | 171 (41%) |
| Witnessed arrest | | |
| Bystander | 308 (74%) | 307 (74%) |
| LAS | 30 (7%) | 25 (6%) |
| Not witnessed | 76 (18%) | 81 (20%) |
| Presenting cardiac rhythm | | |
| AED non-shockable, asystole, or PEA | 184 (44%) | 188 (46%) |
| AED shockable, VF, or pulseless VT | 229 (55%) | 225 (55%) |
| Not known | 1 (<1%) | 0 |
| Initial CPR attempt | | |
| Bystander | 290 (70%) | 313 (76%) |
| LAS | 123 (30%) | 100 (24%) |
| Not performed | 1 (<1%) | 0 |
| Time from arrest to LAS CPR start, min | 9 (7–12); n=278 | 10 (7–12); n=275 |
| First defibrillation performed | | |
| Public access defibrillator | 49 (12%) | 54 (13%) |
| LAS | 211 (51%) | 198 (48%) |
| Not performed | 142 (34%) | 150 (36%) |
| Not known | 12 (3%) | 11 (3%) |
| Time from arrest to first defibrillation, min | 10 (7–14); n=194 | 11 (7–14); n=199 |

| | Cardiac arrest centre group | Standard care group |
|---|---|---|
| **Cardiac Cause** | 63% | 60% |
| **Coronary** | 42% | 38% |
| **Arrhythmia** | 33% | 33% |
| **Cardiomyopathy** | 17% | 19% |

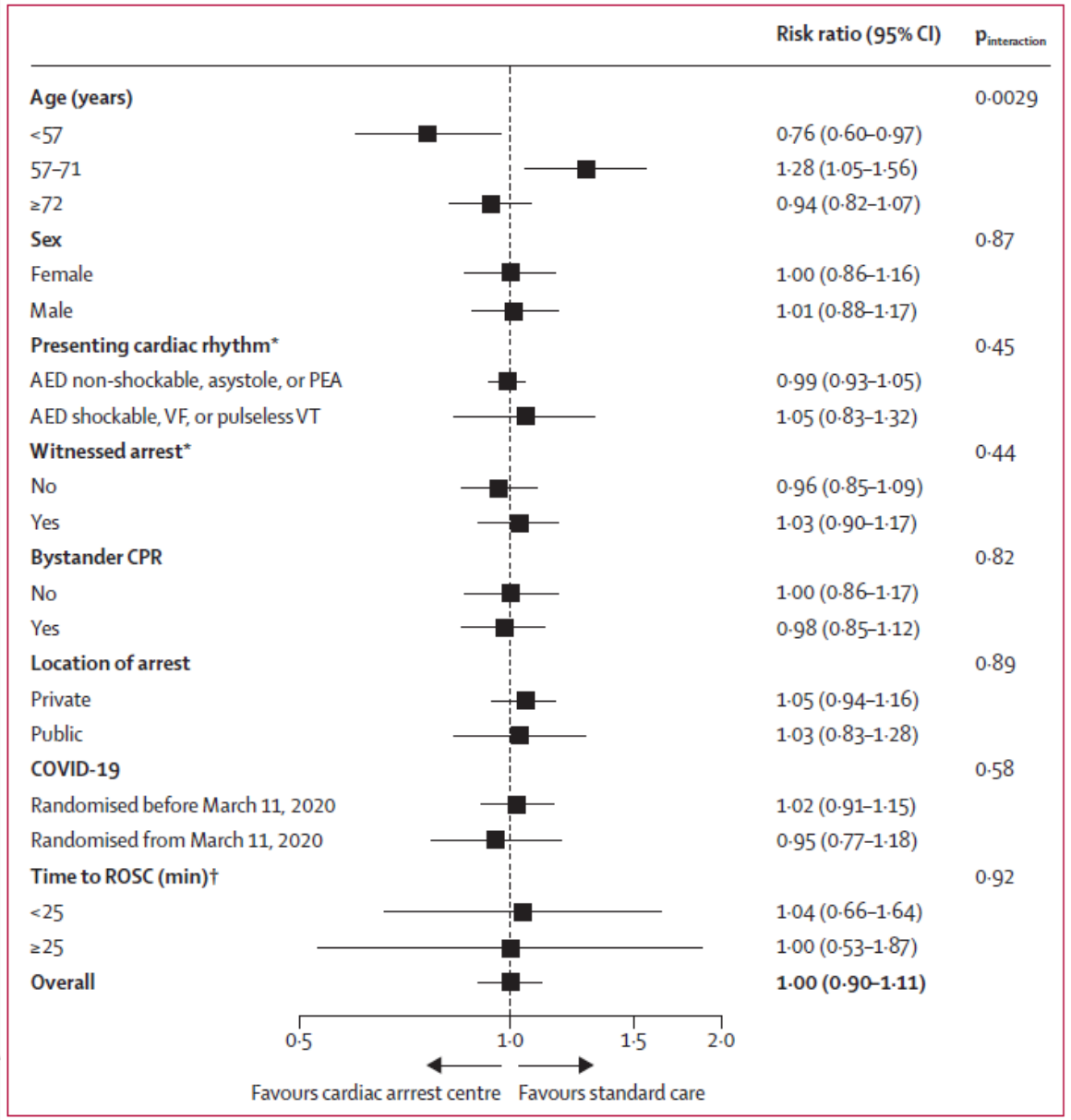
# Results: Primary endpoint



# Results: Secondary endpoints

| | Cardiac arrest centre group (n=414) | Standard care group (n=413) | RR, OR, or mean difference (95% CI) | Adjusted OR* (95% CI) or p value | Risk difference (95% CI) |
|---|---|---|---|---|---|
| **Primary endpoint** | | | | | |
| 30-day mortality | 258/411 (63%) | 258/412 (63%) | RR 1·00 (0·90 to 1·11) | 1·09 (0·73 to 1·63) | 0·2% (–6·5 to 6·8) |
| **Secondary endpoints** | | | | | |
| 3-month mortality | 267/411 (65%) | 263/411 (64%) | RR 1·02 (0·92 to 1·12) | .. | 1·0% (–5·6 to 7·5%) |
| mRS score at discharge | | | OR 1·00 (0·76 to 1·32) | 0·99 | .. |
| 0 | 70/413 (17%) | 78/402 (19%) | .. | .. | .. |
| 1 | 23/413 (6%) | 31/402 (8%) | .. | .. | .. |
| 2 | 22/413 (5%) | 12/402 (3%) | .. | .. | .. |
| 3 | 15/413 (4%) | 9/402 (2%) | .. | .. | .. |
| 4 | 10/413 (2%) | 2/402 (1%) | .. | .. | .. |
| 5 | 16/413 (4%) | 12/402 (3%) | .. | .. | .. |
| 6 | 257/413 (62%) | 258/402 (64%) | .. | .. | .. |

# Subgroup analysis



# Conclusions

- In adult patients without ST elevation, transfer to a cardiac arrest centre following resuscitated out-of-hospital cardiac arrest in the community **did not reduce deaths at 30 days**
- There was no difference in deaths at 3 months
- There was no difference in neurological outcome

בשיתוף:
עמותה לקרדיולוגיה בישראל (ע"ר)
ISRAEL CARDIOLOGY ASSOCIATION

החוג לקרדיולוגיה בקהילה
THE ISRAEL WORKING GROUP ON CARDIOLOGY IN THE COMMUNITY

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