THE CARDIOGENIC SHOCK TEAM

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Shock teams definition

- **Multidisciplinary team:**

  Cardiac intensivist

  Interventional cardiologist

  MCS specialist

  Cardiovascular surgeon

  Nurses, perfusionist, and others

Moghaddam, Nima, et al. *ESC heart failure* 8.2 (2021): 988-998.

Shock teams ?

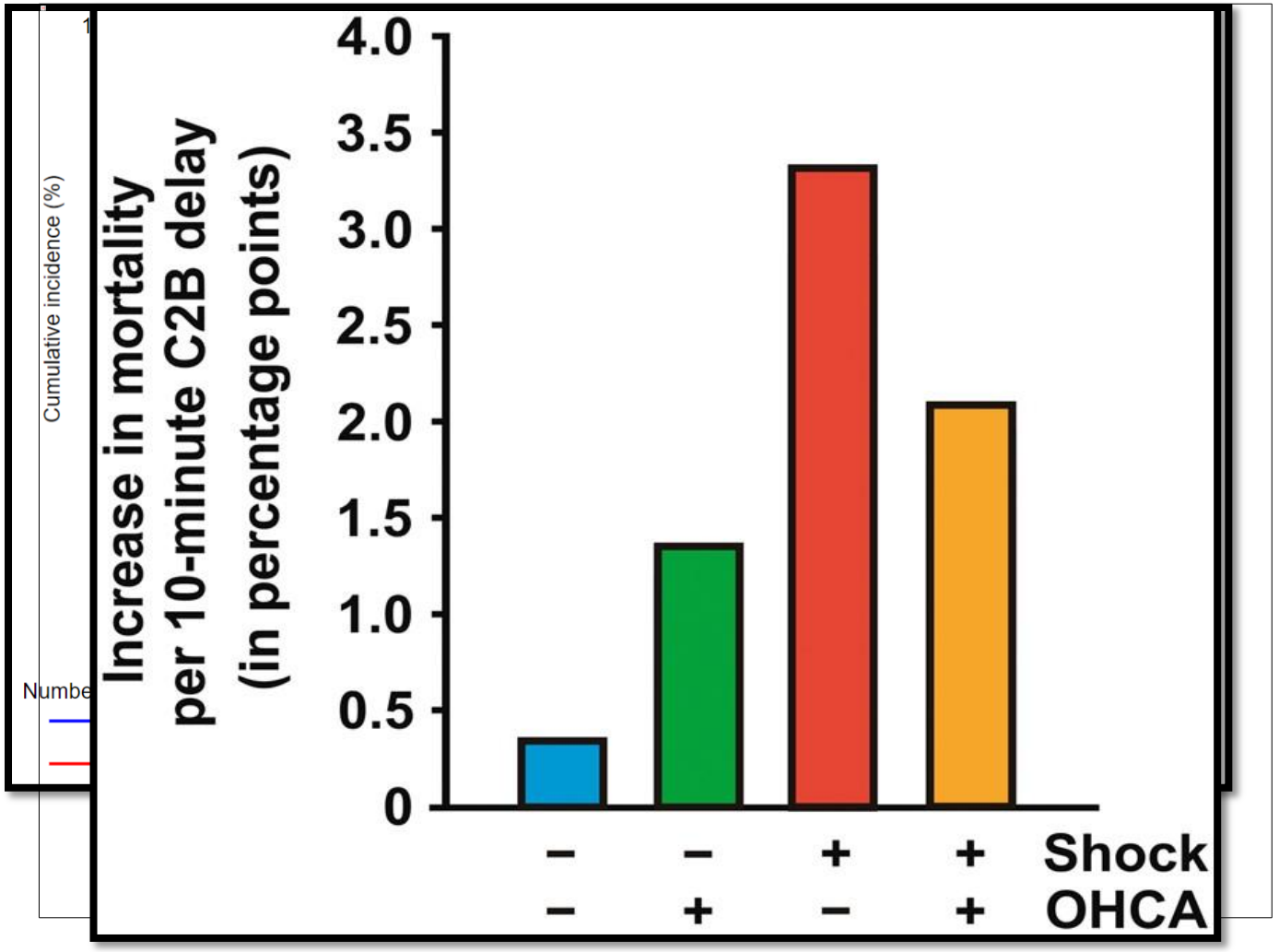
- The foundation of CV care has always been **teamwork**, so why do we need shock teams?

Do we need shock teams?

- The mortality of patients with CS remains very high (50%).
- CS is a time-sensitive condition.
  10min delay = 3.31 deaths/100 pts
- HETEROGENEOUS POPULATION, SYNDROME, DIFFERENT CLINICAL SCENARIOS AND TREATMENTS

→ NO „ONE-SIZE-FITS-ALL“ APPROACH

→ PATIENT TAILORED THERAPY



Ostadal, Petr, et al. Circulation (2022).

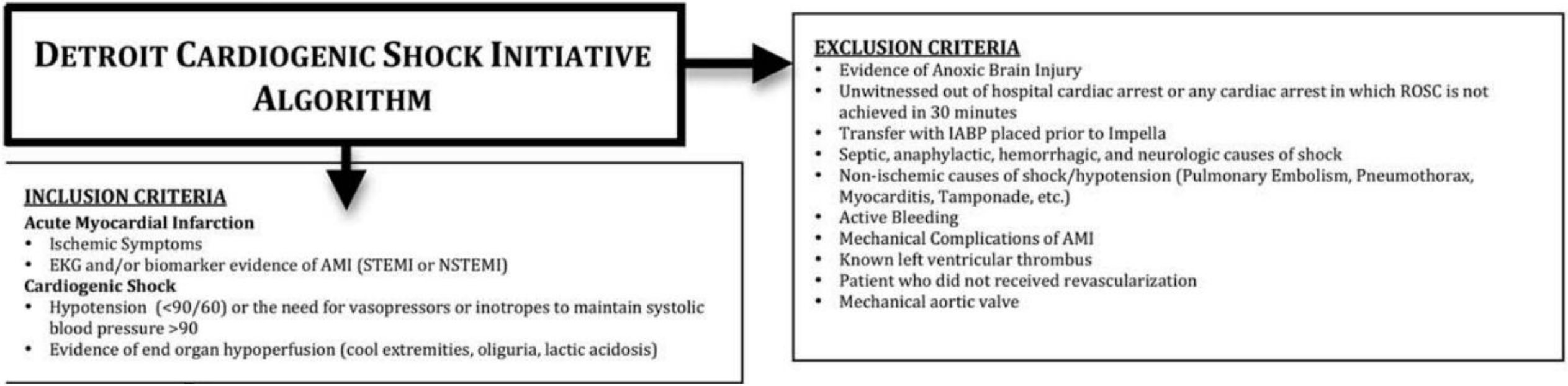
Thiele, H., et al (2023). New England Journal of Medicine, 389(14), 1286-1297.

Scholz, Karl Heinrich, et al. "FITT-STEMI trial." European heart journal 39.13 (2018): 1065-1074.

Current evidence for shock teams

The Detroit Cardiogenic Shock Initiative and The National Cardiogenic Shock Initiative

- Single-arm, prospective, observational, multicenter study
- Early MCS (Impella) in AMICS treated with PCI
- 1st Phase - 4 centers (41 patients), 2nd Phase - 35 centers (171 patients)



Basir, M. B., et al. (2018). Catheterization and Cardiovascular Interventions, 91(3), 454-461.

Basir, M. B., & National Cardiogenic Shock Initiative Investigators. (2019). Catheterization and Cardiovascular Interventions, 93(7), 1173-1183.

ACTIVATE CATH LAB

ACCESS & SUPPORT

- Obtain femoral arterial access (via direct visualization with use of ultrasound and fluoroscopy)
- Obtain venous access (Femoral or Internal Jugular)
- Obtain either Fick calculated cardiac index or LVEDP

IF LVEDP >15 or Cardiac Index < 2.2 AND anatomy suitable, place IMPELLA

Coronary Angiography & PCI

- Attempt to provide TIMI III flow in all major epicardial vessels other than CTO
- If unable to obtain TIMI III flow, consider administration of intra-coronary vasodilators

Perform Post-PCI Hemodynamic Calculations

1. Cardiac Power Output (CPO): $\frac{\text{MAP x CO}}{451}$

2. Pulmonary Artery Pulsatility Index (PAPI): $\frac{\text{sPAP – dPAP}}{\text{RA}}$

**** QUALITY MEASURES ****

- Door to Support Time < 90 minutes
- Establish TIMI III Flow
- Wean off Vasopressors & Inotropes
- Maintain CPO >0.6 W
- Improve survival to discharge to >80%

Wean OFF Vasopressors and Inotropes

If CPO is >0.6 and PAPI >0.9, operators should wean vasopressors and inotropes and determine if Impella can be weaned and removed in the Cath Lab or left in place with transfer to ICU.

Escalation of Support

If CPO remains <0.6 operators should consider the following options:

- PAPI is <0.9 consider right sided hemodynamic support
- PAPI >0.9 consideration for additional hemodynamic support

Local practice patterns should dictate the next steps:

- Placement of more robust MCS device(s)
- Transfer to LVAD/Transplant center

If CPO is >0.6 and PAPI <0.9 consider providing right sided hemodynamic support if clinical suspicion for RV dysfunction/failure

Vascular Assessment

- Prior to discharge from the Cath Lab, a detailed vascular exam should be performed including femoral angiogram and Doppler assessment of the affected limb.
- If indicated, external bypass should be performed.

ICU Care

- Daily hemodynamic assessments should be performed, including detailed vascular assessment
- Monitor for signs of hemolysis and adjust Impella position as indicated

Device Weaning

Impella should only be considered for explantation once the following criteria are met:

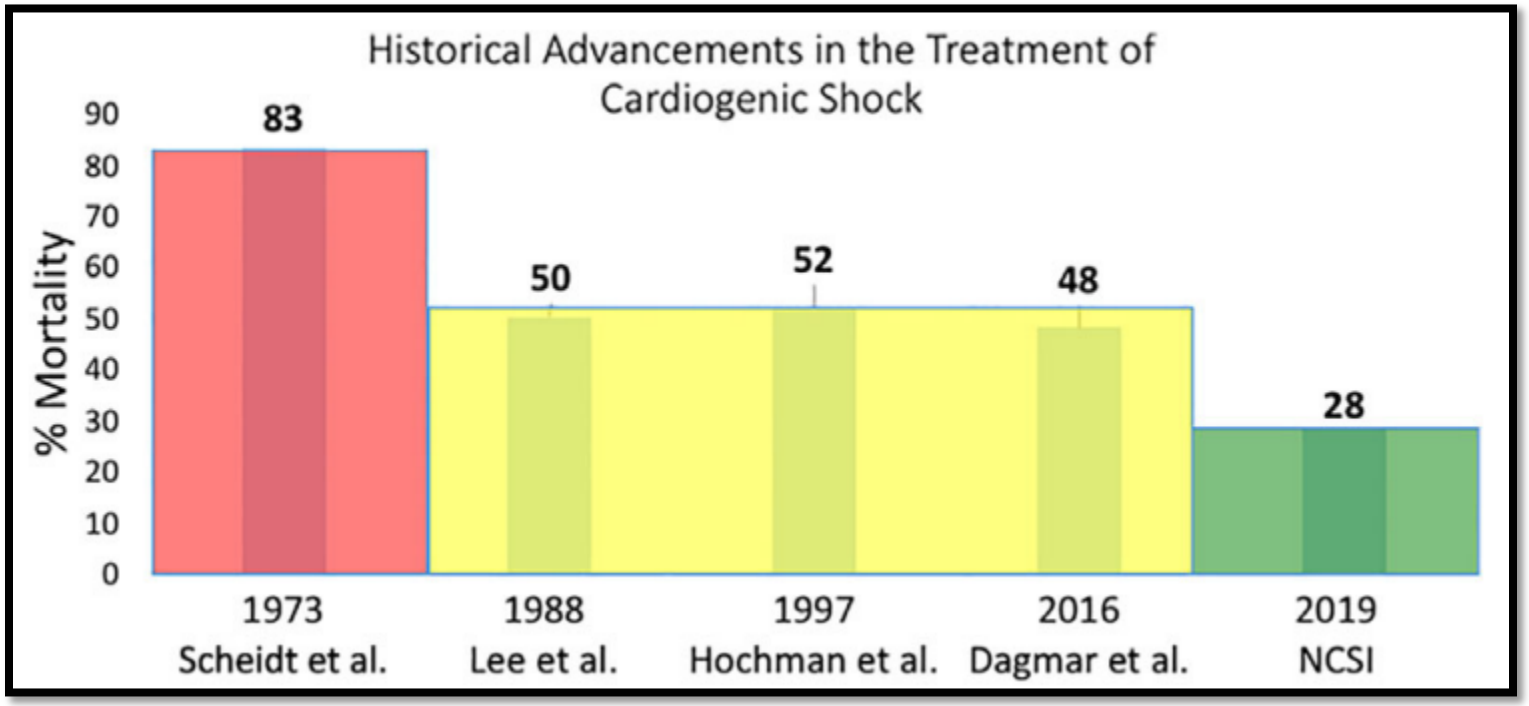
- Weaning off from all inotropes and vasopressors
- CPO >0.6, and PAPI > 0.9

Bridge to Decision

Patients who do not regain myocardial recovery within 3-5 days, as clinically indicated, should be transferred to an LVAD/Transplant center. If patients are not candidates, palliative care options should be considered.

Results

- Survival to explant vs. historical controls (**85% vs 51%** $p < 0.001$)
- Survival to discharge **72%**

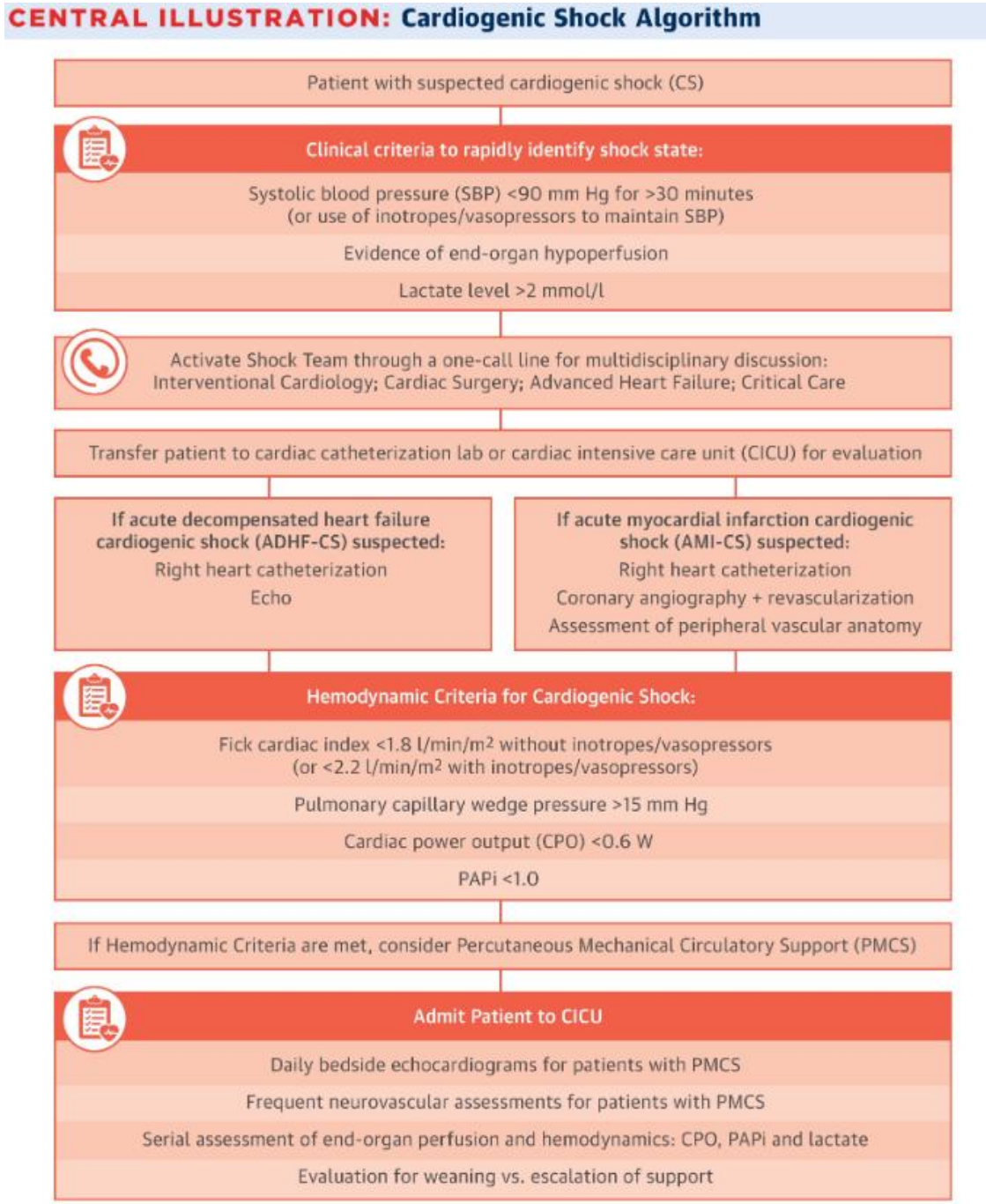


- Limitations - single-arm, observational, 118/289 pts excluded, selection bias

Basir, M. B., & National Cardiogenic Shock Initiative Investigators. (2019). Catheterization and Cardiovascular Interventions, 93(7), 1173-1183.

INOVA Heart and Vascular Institute Shock Team

- Single center observational, retrospective
- 30-day survival in 2016 vs 2017 vs 2018 from **47% to 57.9% and 76.6%** ($p < 0.01$).

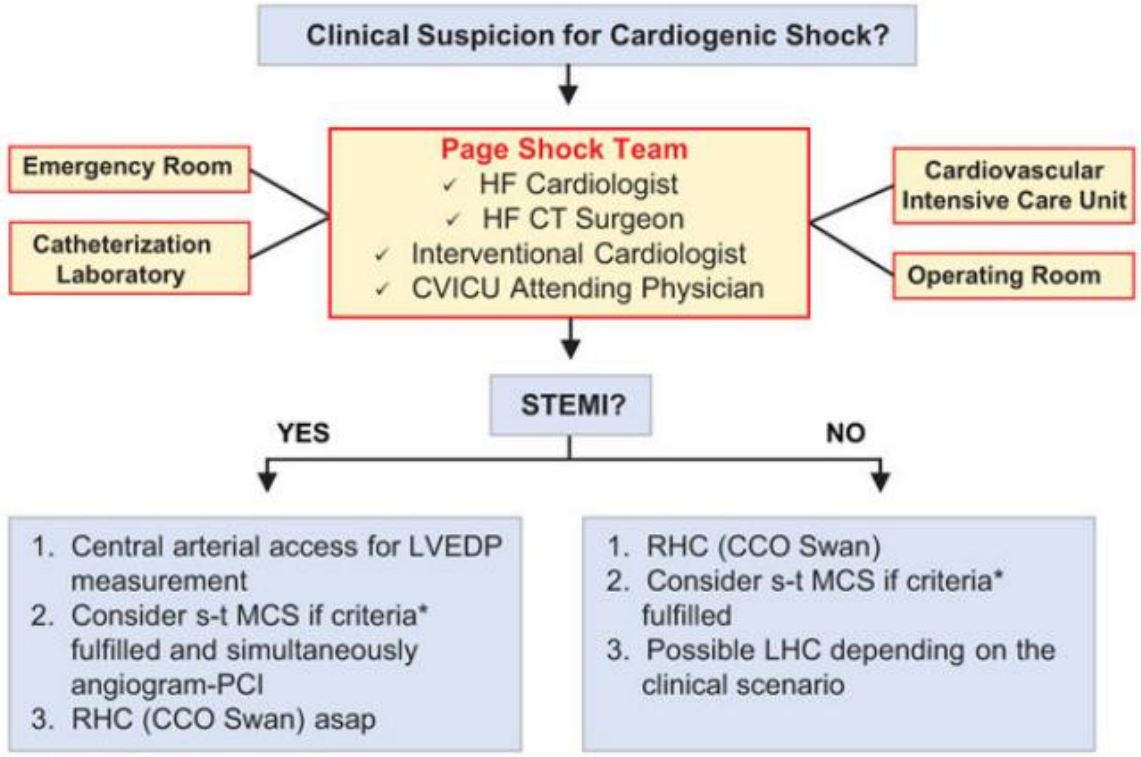


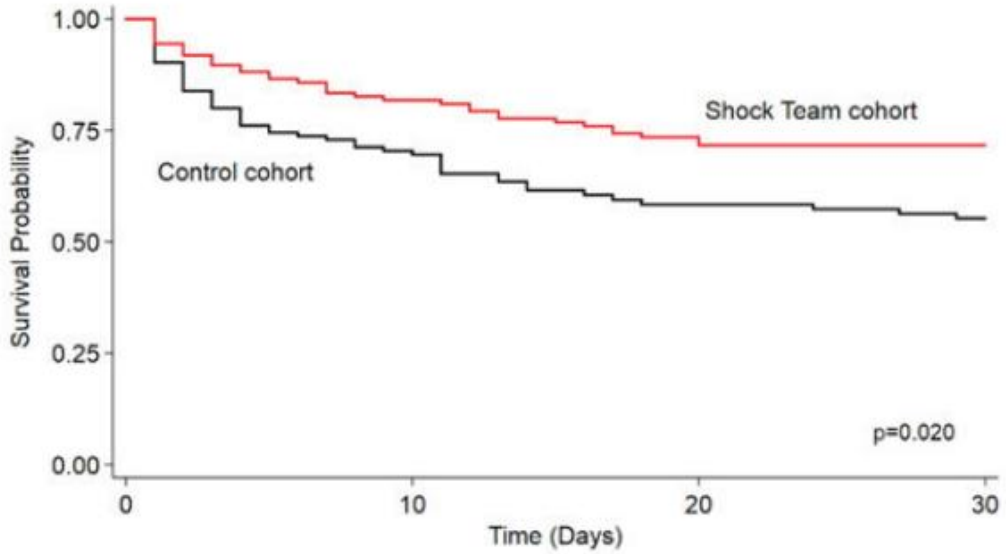
Tehrani. B.N. et al. J Am Coll Cardiol. 2019:73(13):1659-69.

Tehrani, B. N., et al (2019). *Journal of the American college of cardiology*, *73*(13), 1659-1669.

Utah Cardiac Recovery Shock Team

- Single center observational study
- 123 MCS rCS vs 121 MCS rCS historical cohort
- In-hospital survival **61.0% vs 47.9%;** P=0.041
- 30-day mortality HR: 0.61 [95% CI, 0.41–0.93]

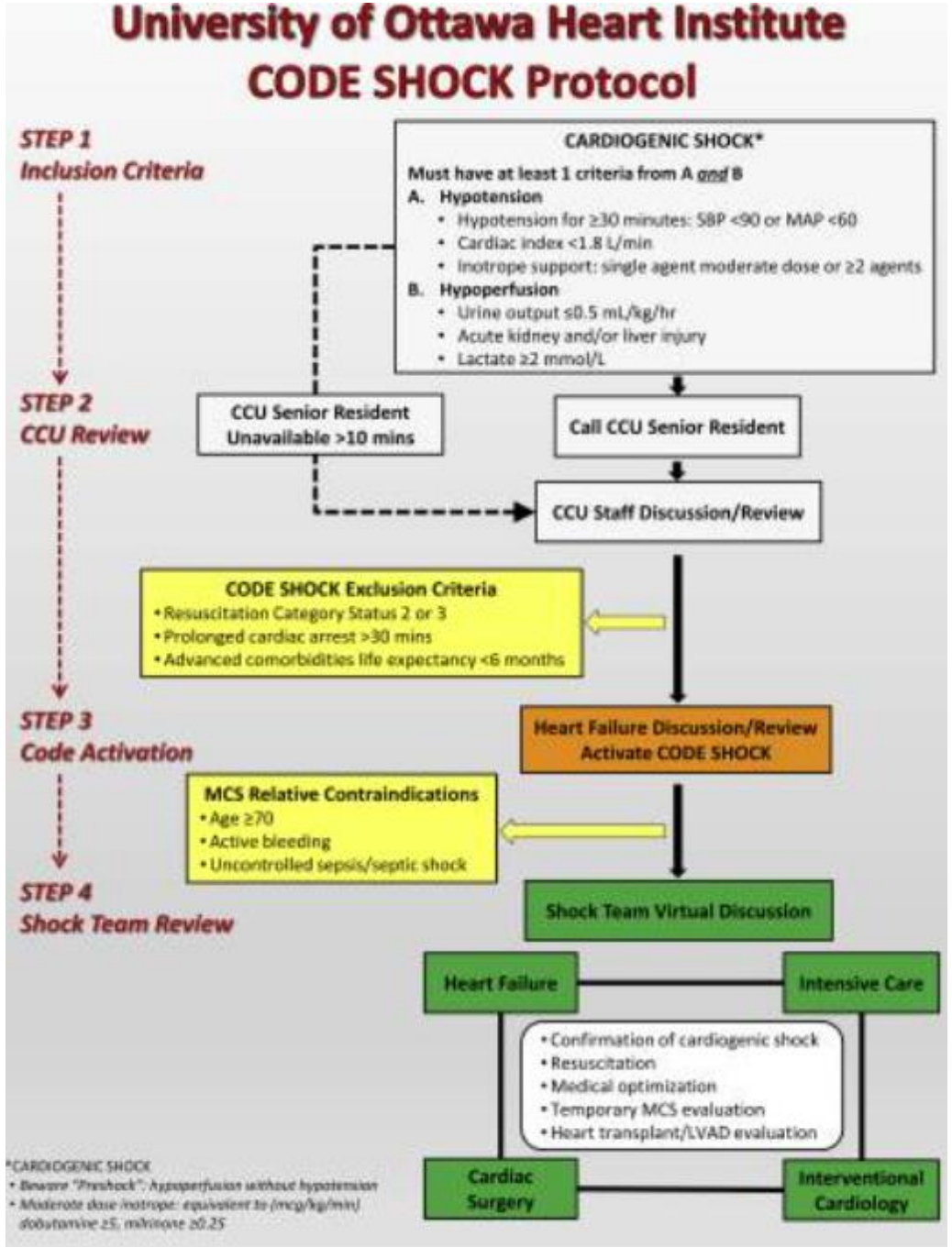




Taleb, I., et al. (2019). Circulation, 140(1), 98-100.

University of Ottawa Heart Institute

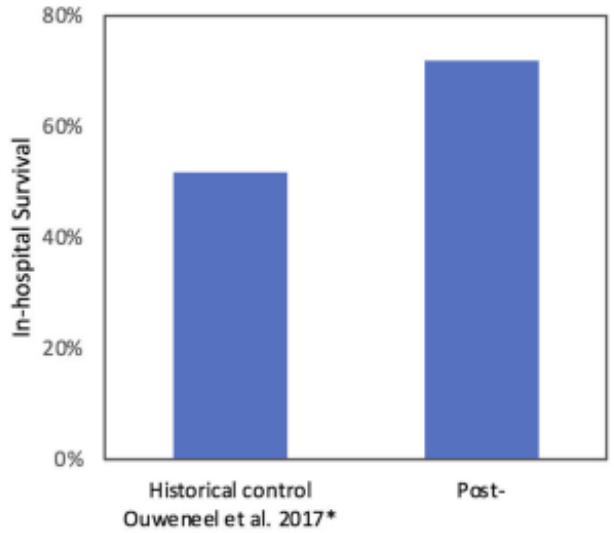
- Single center, observational, retrospective
- 100 pts (64 shock code vs. 36 controls)
- Increased use of MCS 45% vs 28%
- No difference in 30-days survival
- 240 days follow-up, survival 67% vs 42%



Lee F, et al. CJC Open 2020: 249–257.

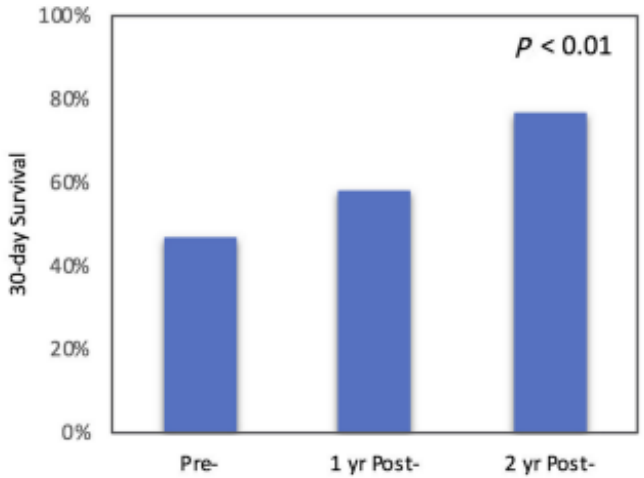
A

NATIONAL CARDIOGENIC SHOCK INITIATIVE



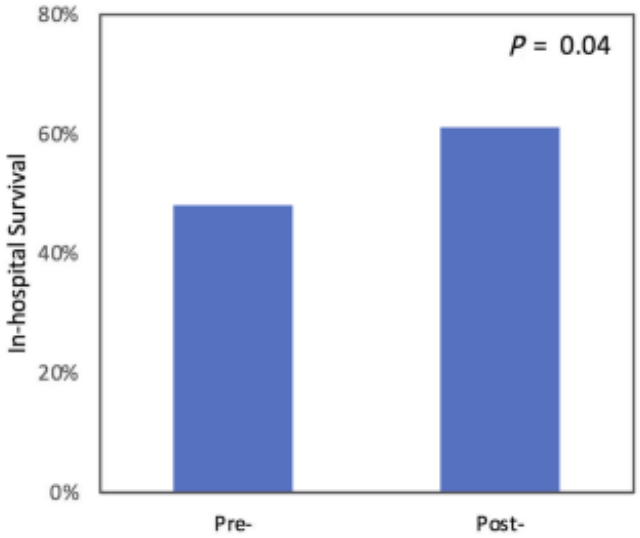
B

INOVA HEART & VASCULAR



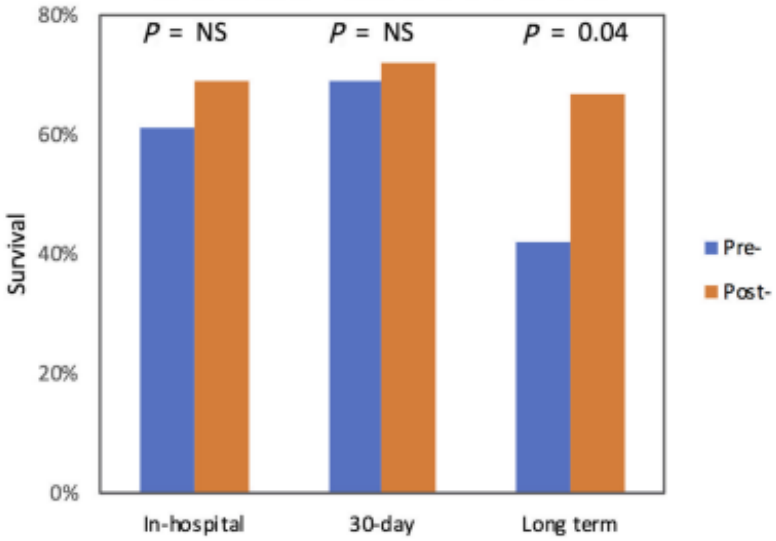
C

HEALTH UNIVERSITY OF UTAH



D

UNIVERSITY OF OTTAWA HEART INSTITUTE

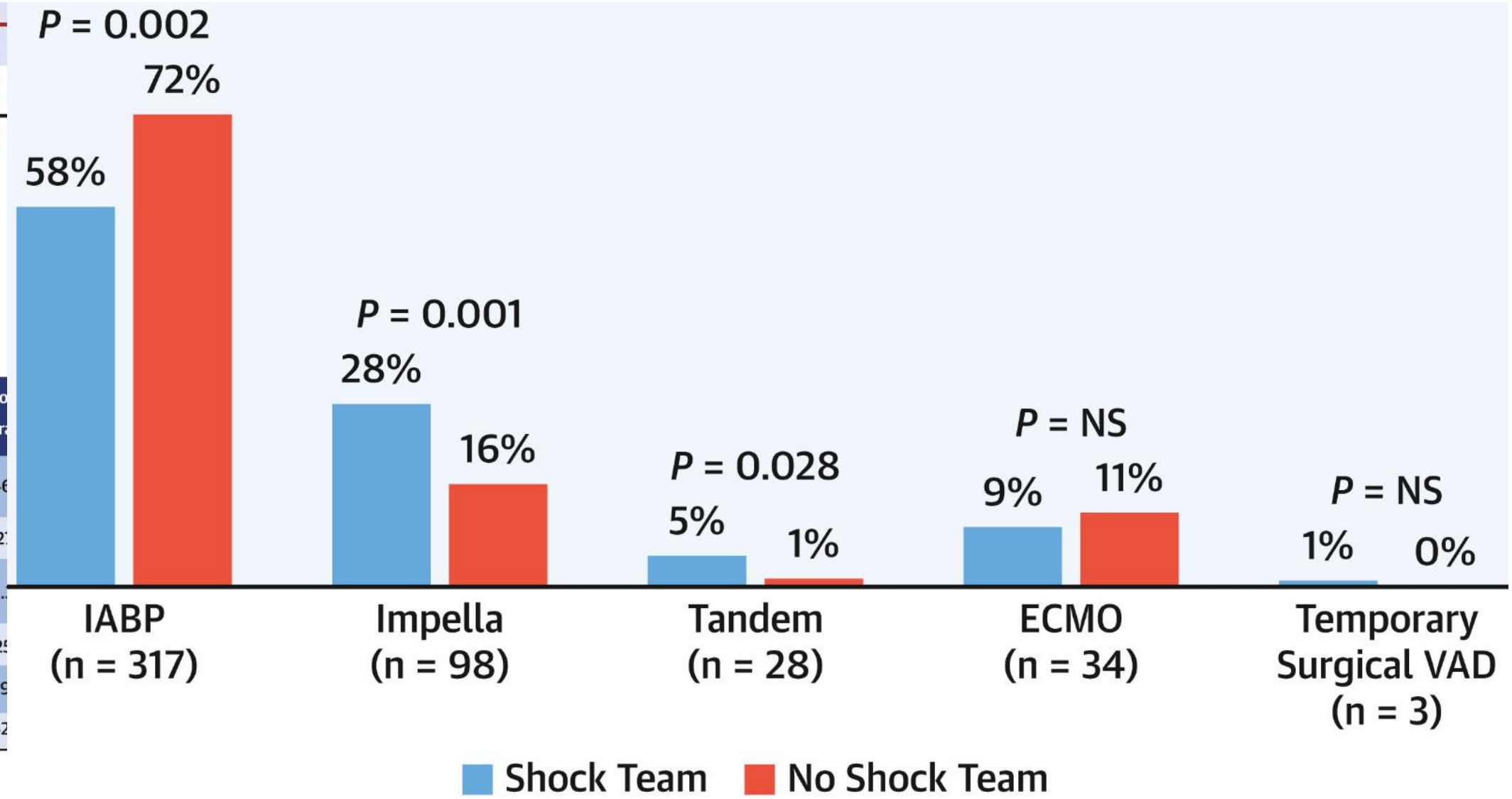


Critical Care Cardiology Trials Network

CENTRAL ILL
ated Outcomes

Cardiogenic Shock Suspected

Shock Team vs No Sho Center Population Char	
Cardiogenic shock admissions (n)	546
AMI-CS (%)	2
Admission lactate (mmol/L)	2.
PCWP (mm Hg)	25
CI (L/min/m²)	1.9
CPO (W)	0.62

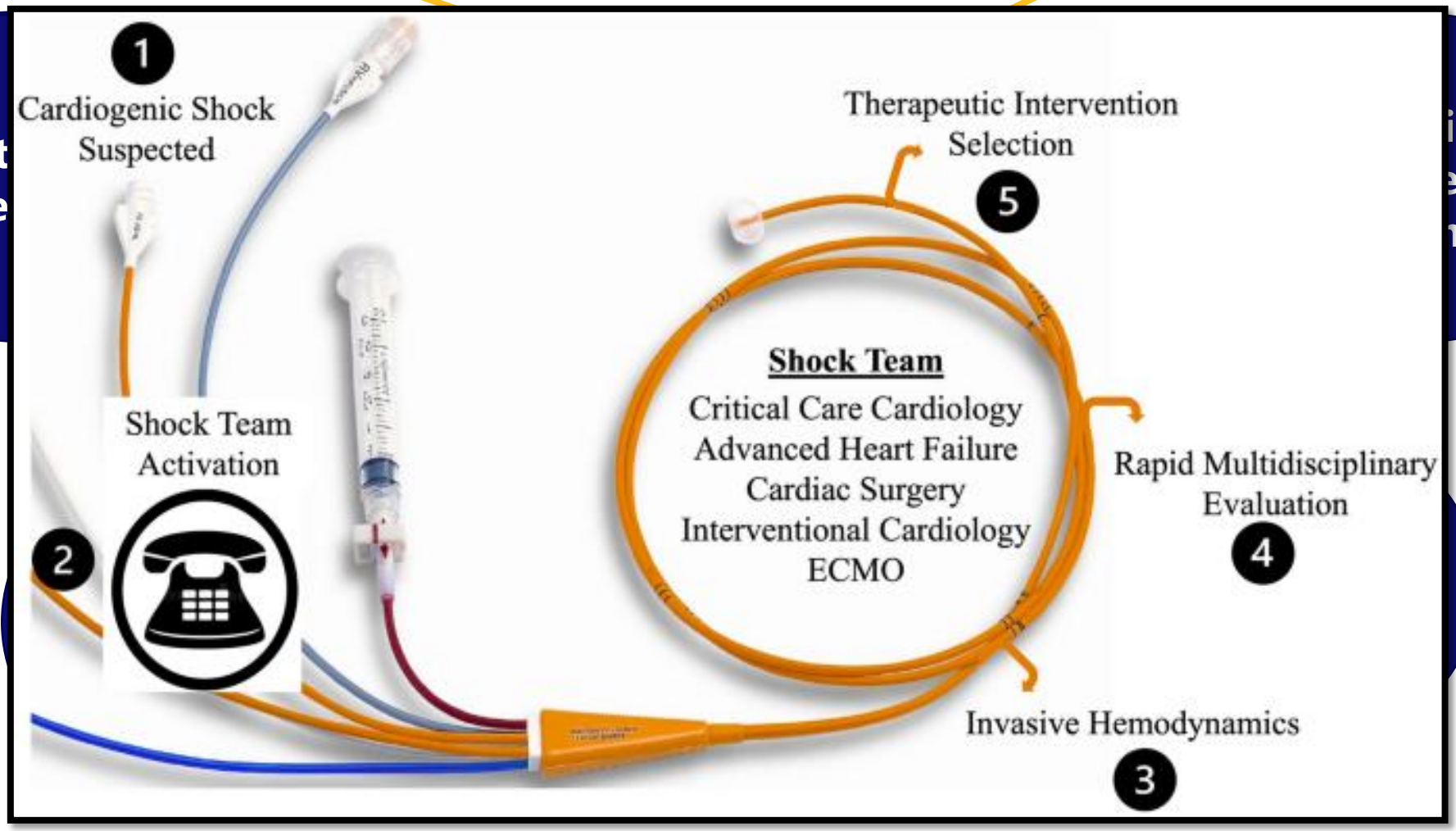


Papolos, A.I. et al. J Am Coll Cardiol. 2021;78(13):1309-1317.

Shock team in GUH

Initial call from EMS, local hospitals, in-hospital calls

Mobile app use



Rob, D., & Bělohlávek, J. (2021). The mechanical support of cardiogenic shock. *Current Opinion in Critical Care*, *27*(4), 440-446.
Graph from Stevenson, M. J., et al. Current Cardiology Reports, 1-7.

Key factors in shared decision making

PATIENT CHARACTERISTICS

- LV, RV and valve function
- Hemodynamic status
- Age, performance status
- Comorbidities (CKD, COPD…)
- Vessel size and tortuosity…

PROCEDURE

- Type (PCI, TAVI, RFA…)
- Risk of deterioration/arrest
- Risk of complications
- Complexity, anatomy
- Vascular access

MCS device

- Effect on LV/RV/valves, circulation
- Estimated time of support
- Vascular access

Rob, D., & Bělohlávek, J. (2021). The mechanical support of cardiogenic shock. *Current Opinion in Critical Care*, *27*(4), 440-446.

+ -

PROS	CONS
Clear communication scheme	Human and financial resources for 24/7
Fast recognition and team activation	Overtreatment ?
Clear roles identification	Increasing bureaucracy
Reducing the risk of individual error	Cost effectiveness ?
Increasing expertise of shock team members, indication + timing of MCS	
Mobile shock team - specifics	

Conclusions

- The treatment of CS is highly complex and time sensitive.
- The establishment of a multidisciplinary team + simple protocol for rapid identification, communication and decision has a very strong ratio.
- The limited observational data suggests that shock teams are associated with increased survival. Randomized data are lacking – clinical equipoise?

More detailed information can by find in:
Rob, D., & Bělohlávek, J. (2022). Mechanical circulatory support in cardiogenic shock and post-myocardial infarction mechanical complications. JGC, 19(2), 130.
Rob, D., & Bělohlávek, J. (2022). ECMO FOR MYOCARDIAL INFARCTION WITH CARDIOGENIC SHOCK. Extracorporeal Membrane Oxygenation: An Interdisciplinary Problem-Based Learning Approach, 435. Oxford University Press.
Rob, D., & Bělohlávek, J. (2021). The mechanical support of cardiogenic shock. *Current Opinion in Critical Care*, *27*(4), 440-446.
Rob, D., et al. (2017). European journal of heart failure, 19, 97-103.