### Extra-Corporeal Membrane Oxygenation During CardioPulmonary Resuscitation ECPR

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### **Disclosures**

· Nothing to disclose.

### Case

- History
  - 60 y/o male
  - No prior history of CAD
  - In car at casino complaining of chest pain
  - Depression, Smoker
  - FH: Father PE, mother renal transplant, brother hyperlipidemia
- Exam
  - Pale, diaphoretic, confused
  - SBP=100, cool extremities

## 

### Case

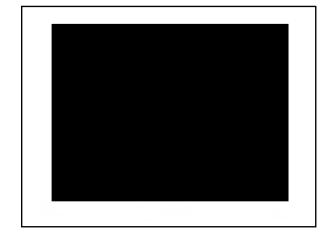
- ED course
  - Progressively obtunded
  - Level 1 activated
  - Ticagrelor 180mg, heparin 4000U, ASA
  - Multiple episodes of ventricular tachycardia
  - Multiple defibrillation, CPR
  - Progressive shock, Intubated
  - External cooling, Lucas, transfer to ANW
  - Labs: pH: 6.8 pO2: 54 pCO2: 58.5 bicarbonate: 9.8, lactate 10.5

### Case Summary

- Acute STEMI
- VT/VF arrest
- Cardiogenic shock
- Recurrent cardiac arrest and refractory shock
  - LUCAS dependent upon arrival (110 minutes)

### **Next Steps**

- Is this patient dead?
- Basic Life Support (BLS)
- Advanced Cardiopulmonary Life Support (ACLS)



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- Is this patient dead?
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- ECMO Cardiopulmonary Life Support (ECLS)

### **ECPR**

- Definition
- Purpose
- Evidence
- Indications
- Methods
- Outcomes

### **ECPR Definition**

The utilization of extra-corporeal membrane oxygenation via femoral venous and arterial access to provide artificial cardiopulmonary circulation as an alternative to traditional ventilation and external cardiac massage

### **ECPR Purpose**

- Improve
  - Outcomes
- Extension
  - Beyond BLS and ACLS for refractory cardiac arrest
- Reversal
  - Management of post resuscitation syndrome
- Bridge
  - Interventional therapies to allow management of potential reversible conditions

### **ECPR Purpose**

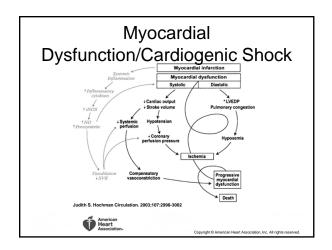
- Improving Cardiac Arrest Outcomes
  - 1950's mortality 50%
    - Stephenson HE Jr. Ann Surg. 1953; 137: 731-744
  - 1966 original consensus statement on CPR
    - National Academy of Sciences-National Research Council Ad Hoc Committee on Cardiopulmonary Resuscitation. Cardiopulmonary resuscitation. *JAMA*. 1966; 198: 372–379
  - Currently overall prognosis after ROSC has only minimally improved

### **ECPR Purpose**

- Research focused on improving the rate of ROSC
- Post Resuscitation Syndrome
  - Brain injury
  - Myocardial Dysfunction/Cardiogenic Shock
  - Systemic Ischemia/Reperfusion Response
  - Persistent Precipitating Pathology

### Systemic Ischemia/Reperfusion Response

- Most severe state of cardiogenic shock
  - Abrupt cessation of oxygen and nutrient delivery
  - Increased oxygen debt
  - Endothelial activation and inflammatory response
  - Multisystem organ failure
- Whole body ischemia/reperfusion
  - Activation of immunological and coagulation pathways
  - Multisystem organ failure

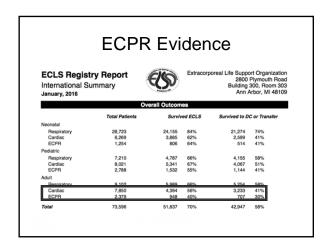


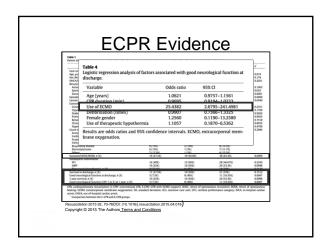
### **ECPR Purpose**

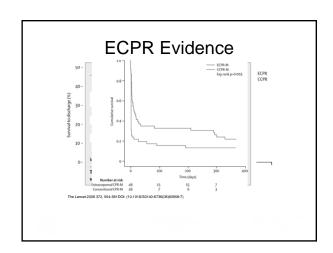
- · Potential role for ECMO
  - Extend resuscitation when ROSC cannot be achieved
  - Reverse the consequences of post resuscitation syndrome
  - Increase likelihood of achieving ROSB
  - Allow evaluation and intervention on underlying etiology of cardiac arrest

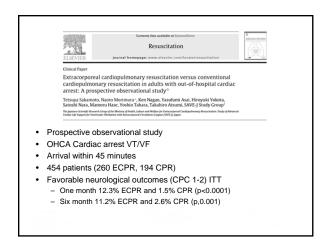
### **ECPR** Evidence

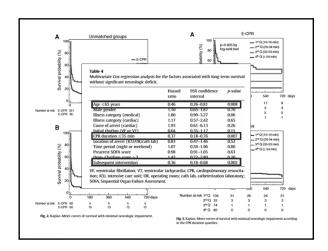
- No prospective randomized clinical trials
- ESLO ECLS Registry
- · Several small observational studies

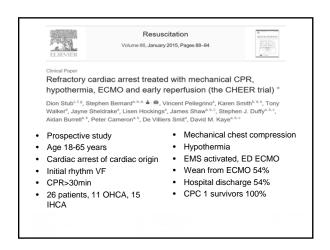


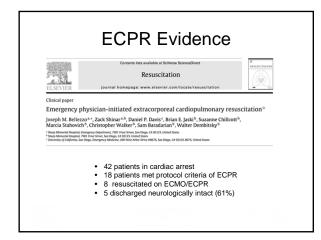












### **ECPR Indications**

2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

Part 6: Alternative Techniques and Ancillary Devices for Cardiopulmonary Resuscitation

2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

Steven C. Brooks, Chair; Monique L. Anderson; Eric Bruder; Mohamud R. Daya; Alan Gaffney; Charles W. Otto; Adam J. Singer; Ravi R. Thiagarajan; Andrew H. Travers

### **ECPR Indications**

2015 Extracorporeal Techniques and Invasive Perfusion Devices: Extracorporeal

There is insufficient evidence to recommend the routine use of ECPR for patients with cardiac arrest. It may be considered for select patients for whom the suspected etiology of the cardiac arrest is potentially reversible during a limited period of mechanical cardiorespiratory support (Class Ilb, LOE C-LD).

new for 2015

### **ECPR Indications**

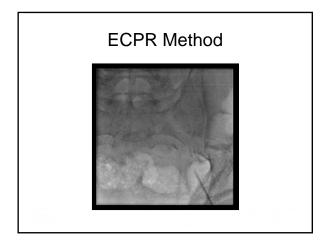
- Similar indications as for BLS/ACLS
  - Patient generally healthy prior to cardiac arrest
  - Goals of therapy are curative
  - Cause of cardiac arrest treatable
- When traditional BLS/ACLS strategies have failed
  - Extension of traditional BLS/ACLS
- · In hospital vs out of hospital

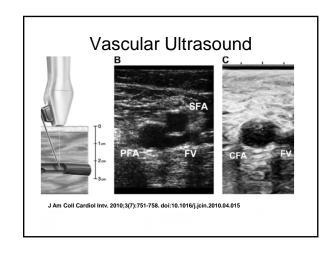
### **ECPR Indications**

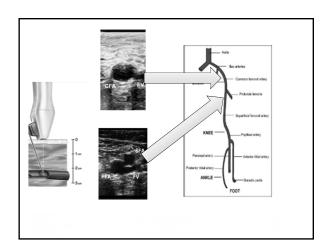
- · ANW in hospital ECPR protocol
  - Age 18-75
  - Arrest of cardiac origin (VT/VF)
  - ETCO2>20
  - Patient on HH4000/5000/5200 or CVICU
  - ECPR candidacy determined at 10 minutes
  - LEVEL 1 ECMO called and patient transferred to cath lab on LUCAS
  - ECMO initiation within 60 minutes of arrest

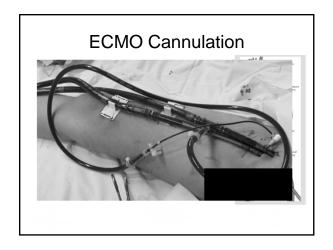
### **ECPR Indications**

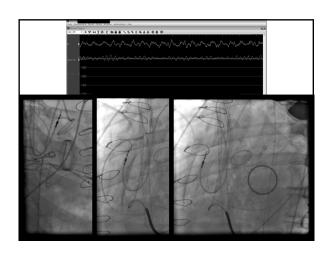
- · ANW out of hospital ECPR protocol
  - Age 18-75
  - Witnessed arrest of cardiac origin (VT/VF)
  - No flow of less 5 minutes
  - ETCO2>10
  - Consistent MAP during transport (MAP 45mmHg or SBP 70mmHg)
  - LEVEL-1 ECMO activation of the Cath lab
  - ECMO initiation within 60 minutes of arrest



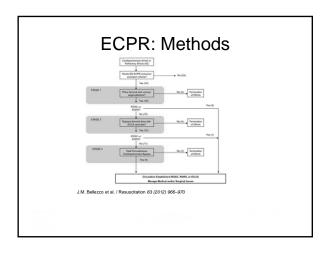


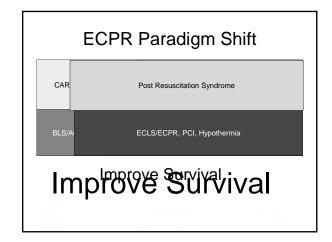


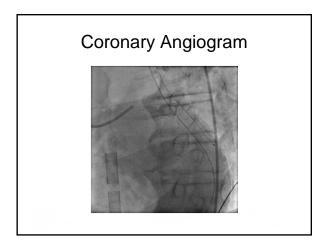


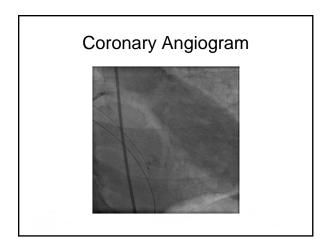


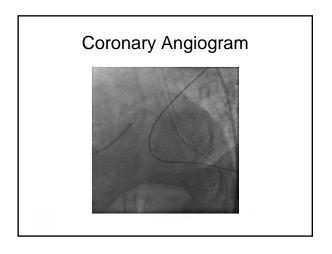
# Table 1 Inclusion criteria. Inclusion criteria: Persistent cardiopulmonary arrest despite traditional resuscitative efforts Shock (SBP < 70 mmHg) refractory to standard therapies Exclusion criteria: Initial rhythm asystole Chest compressions not initiated within 10 min of arrest (either bystanders or EMS personnel) Estimated EMS transport time > 10 min Total arrest time > 60 min Suspicion of shock due to sepsis or hemorrhage Pre-existing severe neurological diseases prior to arrest (including traumatic brain injuny, stroke, or severe dementia) SBP, systolic blood pressure; EMS, emergency medical services. J.M. Belezzo et al. / Resuscitation 83 (2012) 966-970

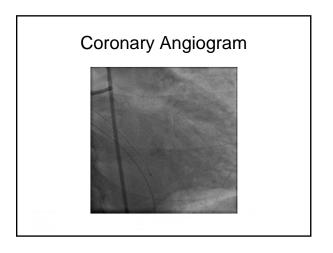












### **Coronary Angiogram**



### Summary

- Improving survival following cardiac arrest continues to be challenging
- ECPR can provide an extension to traditional ACLS for refractory cardiac arrest
- ECPR facilitates the management of post resuscitation syndrome and it's consequences
- ECPR facilitates ROSC/ROSB
- ECPR improve both short term and long term outcomes compared to conventional CPR

### Summary

- ECPR is associated with improved neurological outcomes compared conventional CPR
- Shortening time of CPR with ECPR (<35 min) is associated with better outcomes
- · Cannulation can be challenging
- ECPR provides a bridge to definitive therapy
- ECPR indications are similar to those for BLS/ACLS
- · Patient selection important



"It just so happens that your friend here is only MOSTLY dead. There's a big difference between mostly dead and all dead. Mostly dead is slightly alive!"

-Billy Crystal as Miracle Max The Princess Bride 1987

### Case

