Issues in Establishing The CHEER study
Refractory Out-Of-Hospital Cardiac Arrest Treated With Mechanical CPR, Hypothermia, ECMO And Early Reperfusion

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The CHEER study
Refractory Out-Of-Hospital Cardiac Arrest Treated With Mechanical CPR, Hypothermia, ECMO And Early Reperfusion

Aim

• To conduct a feasibility trial into a therapeutic option for patients with OHCA who do not respond to conventional CPR

Hypothesis

• That mechanical CPR, therapeutic hypothermia, emergency ECMO and transfer to the cardiac catheter laboratory results in a return of a spontaneous circulation and neurological recovery.
Background

- Only 20-50% of people with cardiac arrest can be revived and transported to hospital
- Most patients not transported to hospital with ongoing CPR
  - Hazardous to EMS Crew
  - Previously very difficult
  - ? What more can hospital offer?

Can we develop treatment strategy for this group of patients?
Resuscitation of the Moribund Patient Using Portable Cardiopulmonary Bypass
K Mattox, M.D. A Beall Jr., M.D. 1976

ECMO Facilitated CPR
ECPR

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Surv ECLS</th>
<th>Surv to DC</th>
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<tbody>
<tr>
<td>Neonatal</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Respiratory</td>
<td>24,344</td>
<td>20,608</td>
<td>85% 18,276</td>
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<tr>
<td>Cardiac</td>
<td>4,232</td>
<td>2,586</td>
<td>61% 1,663</td>
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<tr>
<td>ECPR</td>
<td>640</td>
<td>403</td>
<td>63% 245</td>
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<tr>
<td>Pediatric</td>
<td></td>
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<tr>
<td>Respiratory</td>
<td>4,771</td>
<td>3,094</td>
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<td>Cardiac</td>
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<td>3,322</td>
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<tr>
<td>ECPR</td>
<td>1,220</td>
<td>646</td>
<td>53% 479</td>
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<tr>
<td>Adult</td>
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<tr>
<td>Respiratory</td>
<td>2,340</td>
<td>1,474</td>
<td>63% 1,261</td>
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<tr>
<td>Cardiac</td>
<td>1,540</td>
<td>812</td>
<td>53% 598</td>
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<tr>
<td>ECPR</td>
<td>516</td>
<td>201</td>
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<tr>
<td>Total</td>
<td>44,824</td>
<td>33,126</td>
<td>74% 27,833</td>
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ELSO Registry Report, January 2011

Interventional Cardiology

Should We Emergently Revascularize Occluded Coronaries for Cardiac Arrest?

Rapid-Response Extracorporeal Membrane Oxygenation and Intra-Arrest Percutaneous Coronary Intervention

SAVE-J
Study of Advanced life support for Ventricular fibrillation with Extracorporeal circulation in Japan(SAVE-J)
Mechanisms of ECPR
Improving rates of ROSC

ECPR increases coronary perfusion pressure and changes VF amplitude Resulting in significant improvement in rates of successful resuscitation.

Stub, Byrne, Pellegrino, Kaye *Heart Lung Circ* 2013
The CHEER study
Refractory Out-Of-Hospital Cardiac Arrest Treated With Mechanical CPR, Hypothermia, ECMO And Early Reperfusion

1) CPR to hospital
   • Automated CPR enabling safe transport to hospital with effective CPR

2) Hypothermia
   • Initiated pre-hospital for neuroprotection

3) ECMO
   • Manage Refractory Cardiac arrest

4) Early Reperfusion
   • Coronary Angiogram
   • Diagnose and treat underlying aetiology
**Who to include**

- Adults < 65 years (initially 60 years)
- Cardiac arrest due to presumed cardiac cause
- CPR within 10 minutes by bystanders or EMS
- Initial rhythm VF
- Remains in cardiac arrest at the scene for 30 minutes
- Within 10 minutes transport time to The Alfred
- working hours (9am-5pm, Monday to Friday)

**Exclusions**

- Non-cardiac cause of cardiac arrest such as trauma, hanging, drowning, intracranial bleeding
- Any pre-existing significant neurological disability
- Significant non-cardiac co-morbidities that cause limitations in activities of daily living such as:
  - COPD, cirrhosis of the liver, renal failure on dialysis, terminal illness due to malignancy
  - Morbid Obesity
Paramedic Procedures

**Step 1:**
Continuing Arrest at 30 mins:
1. Place patient on Autopulse
2. Ongoing Mechanical ventilation and intravenous adrenaline 1mg every 5mins
3. Rapid infusion of 2L ice-cold saline (unless already administered)

**Step 2:**
1. Transported Code 1 to the Alfred Hospital.
2. Alert Emergency Department of the expected time of arrival of the patient
Procedures in Hospital

**Step 1:**
- Ambulance phone with expected time of arrival
- ED will mobilise Cardiac Arrest team

**Step 2.**
- The ED will receive the patient and transfer to the hospital stretcher with Autopulse continuing.
- 2-4L of cold saline will be infused rapidly
- ICU will cannulate and connect the ECMO circuit

**Step 3**
- Once stable on VA ECMO, the patient will be transported to the cardiac catheterisation laboratory for coronary angiogram +/- PCI

**Step 4**
- The patient will be transported from the cath lab to the ICU.
- Therapeutic hypothermia for 24 hours

**Step 5**
- Cease sedation at 36 hours
- Neuro prognostication at 96 hours
## Early CHEER Experience

<table>
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<tr>
<th>Age</th>
<th>Arrest (mins)</th>
<th>ECMO</th>
<th>Cath lab</th>
<th>ROSC</th>
<th>Outcome</th>
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<tr>
<td>53</td>
<td>80</td>
<td>No</td>
<td>PCI – RCA</td>
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<td>Normal D/C home Day 8</td>
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<td>59</td>
<td>73</td>
<td>Yes</td>
<td>Type A Dissection</td>
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<tr>
<td>57</td>
<td>135</td>
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<td>PCI-LAD</td>
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<td>Died</td>
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<td>50</td>
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<td>PCI-LAD</td>
<td>Yes</td>
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<td>38</td>
<td>66</td>
<td>No</td>
<td>No CAD</td>
<td>Yes</td>
<td>Normal D/C home day 17</td>
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ECPR - CHEER
Future Directions?

• Expand MICA units with automated CPR devices
• Consider greater transport time to Alfred Hospital
• Aim for 24 hour 7 day a week ECPR service
• Increase number of participating Hospitals
• ??? Early transport of patient with active Resuscitation