Protocol for patients with Out of Hospital Cardiac arrest (OOHCA) and possible cardiac cause.

Survival with good neurological recovery post OOHCA is low and has remained so for many years. Around 5-10% of all such patients will make a good recovery. However, the prognosis is significantly better in selected patients, particularly where the presumed cause is an acute myocardial infarction with prompt resuscitation. Survival rates of 30-50% are reported[1-3](local audit at JCUH, personal communication from Dr Monkhouse), even when the patient is comatose. A primary cardiac cause for circulatory arrest in an adult can be considered likely if there is no obvious alternative explanation for arrest (e.g. trauma/drowning/blood loss/septicaemia/airway obstruction). There may be no history of chest pains or previous cardiac problems. Non-cardiac causes include intracerebral haemorrhage and pulmonary embolus. Cardiac causes include acute coronary thrombosis (as in an STEMI), critical ischaemia (eg severe 3 vessel disease), scar-related ventricular arrhythmias, bradycardias or cardiomyopathies. Acute coronary occlusion is found on angiography in between 16% and 48% of OOHCA patients[4, 5]. It seems likely that only those with an acute coronary thrombosis are likely to benefit from early PCI. This is largely predicted by ST elevation [4-7] and so selected patients with persistent ST elevation on their ECG may benefit from urgent coronary angiographic assessment and angioplasty[3]. Several national and international guidelines support the early use of angiography in OOHCA survivors with ST elevation[8-10]

The majority of OOHCA patients should be admitted to A&E (where the receiving team are able to get urgent cardiology/medical input at any time). A minority will meet criteria for considering immediate angiography.

Patients with OOHCA can be stratified as follows:

1) Patients who are post resuscitation (after whatever initial arrhythmia/means of CPR) with:
   - Return of spontaneous circulation (ROSC) AND
   - ECG evidence of acute ST elevation infarction AND
   - Spontaneous respiration and Alert or responding to Vocal stimuli on the AVPU scale.

   These patients should be referred to the PPCI centre immediately as per other STEMI patients. They will be admitted direct to cath lab.

2) Patients who are post resuscitation (after whatever initial arrhythmia/means of CPR) with
   - ROSC AND
   - ECG evidence of acute ST elevation infarction BUT
   - Are still being ventilated or are responding to Pain only or Unresponsive on the AVPU scale.
The crew should immediately discuss the patients with the PPCI centre. The benefits of urgent PCI are however much less clear cut in this sicker group[4] so each case will need a consultant interventionist’s decision as to whether they are happy to accept the patient. Key information will be needed to guide this decision and must be relayed by the paramedic crew:

Was arrest witnessed?

Was CPR (bystander or paramedic) commenced within 5 minutes of arrest?

Was initial rhythm VF/VT?

Was ROSC achieved in less than 30 mins/with less than 6mg adrenaline?

If the answer to any of these questions is no, then available data[1-3, 11, 12] would suggest a poorer survival/neurological recovery, irrespective of treatment offered (see figures below). The expectation will remain that most of these patients will not be accepted for immediate angiography and will therefore go to nearest A&E department.

It is also very important that other clinical information is made available to guide clinical decision making including patient’s age, previous cardiac history particularly of CABG and premorbid state.

Only with explicit acceptance by the on call interventional cardiologist should the patient be brought directly to the cath lab. Patients not accepted should be taken to nearest A&E for further assessment/ITU admission as appropriate.

3) Patients who are post resuscitation (after whatever initial arrhythmia/means of CPR) with

- ROSC BUT
- Do not have ST elevation.

It is much less likely that the cause of cardiac arrest in this situation is an acute coronary occlusion and so immediate angiography is unlikely to be of benefit. There are cases series where a minority of patients post OOHCA have been found to have acute vessel occlusion without ST elevation and the reliability of ST elevation post arrest in detecting this has been questioned[5, 13]. It does seem likely though that most patients with acute MI will have some abnormality of the surface ECG (ST depression, widened QRS complex)[14].
Patients in this category should be taken to nearest A&E where further assessment can be performed and those felt to be possibly due to an acute MI (ie abnormal ECG) AND without the above adverse predictors of poor neurological recovery should be discussed promptly with the PPCI centre on call interventional cardiologist who may accept selected patients for angiographic assessment

4) Patients who have ECG evidence of acute ST elevation infarction and who have been accepted for PPCI and then suffer a cardiac arrest with ROSC en route to hospital, should **continue to PPCI centre**. If patient is comatose/requiring ventilation, this should be communicated urgently to PPCI centre team who will make appropriate arrangements.

5) Patients who have ECG evidence of acute ST elevation infarction and who have been accepted for PPCI and then suffer a cardiac arrest en route to hospital and are **undergoing further resuscitation** (through manual or mechanical CPR)

- If JCUH/Freeman is the nearest hospital, **contact PPCI centre** to update on patients condition then **continue to PPCI centre cath lab**.

- Even if crew are not near the PPCI centre, it is the recommendation of the interventional cardiology team that such patients should be brought direct to cath lab if this is at all possible. It is accepted that the practicalities of performing continued CPR during a long transfer may mean that rerouting to nearest A&E may be felt necessary by paramedic crew. **Contact PPCI centre to update on patients condition**.

If accepted patients are brought to PPCI centre, patients should be taken directly to the cath lab. In the event that the cath lab team have not yet arrived and the patient is still in cardiac arrest, the CCU senior nurse will accept the patient to CCU for ongoing resuscitation efforts until the interventional consultant arrives to take over management.

It should be noted that a decision not to take a patient emergently to the cath lab does not mean that that patient cannot be considered for angiography at a later point in that admission and there are data to support angiography at some point during the admission for cardiac arrest survivors[15].

**Special circumstances: GNAAS patients**

Patients in of the above categories 1, 4 or 5 who have been lifted by the air ambulance service will be brought directly to JCUH A&E (due to the practicalities of where the helipad is) or Freeman cath lab. Air crews will be met by cath lab team on arrival to take over patient. Patients in categories 2&3 will only be met by the cath lab team if they have been explicitly accepted by them, as per above criteria. Decisions about any other patients who may go from A&E to cath lab will be made in A&E by A&E team in consultation with on call cardiology team.
OOHCA NEAS algorithm

Obvious non-cardiac cause?

Yes → Nearest A&E

No → Continue to cath lab, inform PPCI centre

Already accepted for PPCI at PPCI centre?

Yes → ROSC?

Yes → Continue resuscitation and continue to PPCI centre if possible, inform PPCI centre

No → ROSC at scene?

Yes → ST elevation?

Yes → Self-ventilating and A or V on AVPU?

Yes → Treat as STEMI – immediate referral to PPCI centre with transfer to cath lab.

No → Nearest A&E

No → ST elevation?

Yes → Discuss immediately with PPCI centre.

Witnessed?

Delay to CPR<5mins?

VF/VT initially?

CPR<30mins?

Age/CABG/Premorbid state?

Nearest A&E or PPCI centre as directed by PPCI centre.

No → Nearest A&E
Table 3. Survival Rates and Number Needed to Treat by Clinical Criteria

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pooled Percentage of Cardiac Arrests With Attribute</th>
<th>Low Baseline Survival</th>
<th>High Baseline Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Witnessed by bystander</td>
<td>53% (45.0–59.9)</td>
<td>6.4 (3.5–6.3)</td>
<td>13.3 (5.6–21.5)</td>
</tr>
<tr>
<td>Witnessed by EMS</td>
<td>10% (8.0–11.1)</td>
<td>4.9 (1.3–8.4)</td>
<td>18.2 (3.7–32.8)</td>
</tr>
<tr>
<td>Not witnessed</td>
<td>36% (30.4–46.8)</td>
<td>0.5 (0.2–0.9)</td>
<td>12.1 (7.5–16.7)</td>
</tr>
<tr>
<td>Bystander CPR</td>
<td>32% (26.7–37.8)</td>
<td>3.9 (1.9–6.0)</td>
<td>16.1 (11.5–20.7)</td>
</tr>
<tr>
<td>No bystander CPR</td>
<td>66% (62.6–74.6)</td>
<td>1.1 (0.5–1.8)</td>
<td>12.6 (10.0–14.0)</td>
</tr>
<tr>
<td>Ventricular fibrillation/tachycardia</td>
<td>40% (36.6–43.3)</td>
<td>14.8 (9.4–20.2)</td>
<td>23.0 (13.8–32.2)</td>
</tr>
<tr>
<td>No ventricular fibrillation/tachycardia</td>
<td>60% (56.2–62.9)</td>
<td>0.4 (0.2–0.6)</td>
<td>7.4 (4.1–8.7)</td>
</tr>
<tr>
<td>Asystole</td>
<td>42% (36.0–48.8)</td>
<td>0.2 (0.0–0.5)</td>
<td>4.7 (1.0–8.4)</td>
</tr>
<tr>
<td>No asystole</td>
<td>58% (52.9–62.0)</td>
<td>4.4 (2.1–6.6)</td>
<td>30.1 (23.0–36.1)</td>
</tr>
<tr>
<td>Return of spontaneous circulation</td>
<td>22% (17.7–25.5)</td>
<td>15.3 (9.0–23.3)</td>
<td>33.6 (24.9–42.2)</td>
</tr>
<tr>
<td>No return of spontaneous circulation</td>
<td>78% (74.5–82.3)</td>
<td>0.1 (0.0–0.4)</td>
<td>1.8 (1.5–2.1)</td>
</tr>
</tbody>
</table>

NNT indicates number needed to treat to save 1 life.

Figure 1 taken from Sasson et al [2]

Figure 2 data from the PROCAT registry[3]
References


