

N03: Return of Spontaneous Circulation

Kevin Hons

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Introduction

Return of spontaneous circulation (ROSC) is the resumption of sustained perfusing cardiac activity following cardiac arrest. Regardless of the cause of the cardiac arrest, the hypoxemia, ischemia, and reperfusion that occur during cardiac arrest and resuscitation may damage multiple organ systems. The severity of this damage can vary widely among patients, and even among organ systems within individual patients.

Effective post-cardiac arrest care consists of identification and treatment of the precipitating cause of cardiac arrest, combined with the assessment and mitigation of ischemia and reperfusion injury to multiple organ systems.

In the out-of-hospital environment, ROSC management is oriented towards maintaining appropriate oxygenation, ventilation, and hemodynamics, while attempting to identify the precipitating cause, and initiating rapid conveyance to hospital for further diagnostics and interventions.

Essentials

- Target oxygenation and ventilation to an SpO₂ of 92-98% and EtCO₂ of 30-40 mmHg.
- Avoid hypotension; the target systolic blood pressure is > 90 mmHg (or a mean arterial pressure > 65 mmHg).
- Limit fluid bolus to a maximum of 20 mL/kg unless treating suspected hypovolemia.
- Allow approximately 10 minutes of perfusion before attempting to acquire a 12-lead ECG.
- Elevate the head of cot to 30° where possible.
- Allow passive cooling via minimal blankets and using room temperature saline when fluid bolus is required; do not allow passive cooling in cases of traumatic cardiac arrest.
- Manage dysrhythmias in accordance with the appropriate CPG.
- Consult the [Post Arrest Checklist](#) for additional guidance.
- Consider the etiology of the cardiac arrest and treat according to appropriate CPG.

Additional Treatment Information

- Manage the airway in a staged approach based upon license level.
 - If the patient is able to maintain adequate oxygenation and is ventilating effectively, provide supplemental oxygen only. Titrate oxygen flow rates to the minimum required to maintain SpO₂ ≥ 94%. If pulse oximetry is unreliable because of peripheral perfusion deficits, use the highest available oxygen concentration.
 - Patients who remain comatose following a return of spontaneous circulation may have an advanced airway (either a supraglottic device or an endotracheal tube) placed. Maintain EtCO₂ between 30-40 mmHg. Monitor the patient for changes in level of consciousness, and consider the need for sedation or removal of the airway device should a gag reflex return.
- Hypotension may be managed with normal saline boluses up to 20 mL/kg as required. Large volumes of saline are associated with poor outcomes; paramedics should aim to maintain a systolic blood pressure of 100 mmHg (or a mean arterial pressure of 65 mmHg).
- EPINEPHrine is the preferred vasopressor in post-arrest care.
- The initial post-arrest phase can have bizarre and atypical cardiac rhythms. Treat sustained dysrhythmias in accordance with the appropriate guidelines. Allow at least 10 minutes following the return of spontaneous circulation for the rhythm to stabilize prior to acquiring a 12-lead ECG.
- Except in cases of traumatic cardiac arrest, allow for passive cooling.
- Elevating the head of bed to 30° promotes cerebral drainage and reduces the incidence of cerebral edema and aspiration.
- Check blood sugar and treat hypoglycemia accordingly.

Referral Information

Patients who have been resuscitated from cardiac arrest and who have an identified STEMI on 12-lead ECG, or who have a suspected cardiac cause of their arrest, should be conveyed to the closest PCI centre. If there is no PCI centre within a reasonable conveyance time, the closest hospital must be selected.

Post-arrest patients with suspected non-cardiac causes should be conveyed to the closest hospital.

General Information

- In patients who achieve ROSC after out-of-hospital cardiac arrest, subsequent morbidity and mortality are due largely to the cerebral and cardiac dysfunction that accompanies prolonged systemic ischemia. This syndrome, called the post cardiac arrest syndrome, comprises anoxic brain injury, post cardiac arrest myocardial dysfunction, systemic ischemia/reperfusion response, and persistent precipitating pathology.
- In-hospital treatment for post cardiac arrest syndrome will vary depending on the length of the cardiac arrest, the cause of the arrest, and the pre-existing co-morbidities of the patient.
- In a series in which consecutive post-cardiac arrest patients with a suspected cardiovascular cause were taken to coronary angiography, a coronary artery lesion amenable to emergency treatment was found in 96% of patients with ST elevation and in 58% of patients without ST elevation.
- Although targeted temperature management has been shown to be beneficial in post-arrest care in the hospital environment, there is no evidence to suggest that active out-of-hospital cooling has a positive effect on either survival or neurological recovery. Evidence has demonstrated that large infusions of cool normal saline can adversely affect outcomes.
- Hypothermia < 35°C has a negative effect on the clotting cascade and therefore should be avoided in ROSC following a traumatic cardiac arrest.
- The clamshell can be an excellent tool in extricating the non-traumatic post-arrest patient. Once the patient has been extricated to the stretcher, the clamshell should be removed to allow 30° head up positioning.

Interventions

First Responder

- OPA/BVM/O₂ as required
 - [→ A07: Oxygen Administration](#)
 - Airway management by EMR and FR licensed responders who cannot insert an iGel should provide a tight seal with the BVM using a 2-person technique where possible; an inline viral filter should be used between the mask and the bag-valve device

Emergency Medical Responder – All FR interventions, plus:

- Oxygenation and ventilation
 - OPA/BVM/O₂ as required to maintain SpO₂ 92-98%
 - [→ A07: Oxygen Administration](#)
 - [→ B01: Airway Management](#)
 - Airway management by EMR and FR licensed responders who cannot insert an iGel should provide a tight seal with the BVM using a 2 person technique where possible; an inline viral filter should be used between the mask and the bag-valve device.
- Head up 30° on cot
- Passive cooling
- Rapid conveyance
- Refer to [Post-Arrest Checklist](#)

Primary Care Paramedic – All FR and EMR interventions, plus:

- Oxygenation and ventilation
 - Consider Supraglottic Airway (SGA)
 - [→ PR08: Supraglottic Airway](#)

- If required, the airway should be managed using an iGel with a viral filter pre-connected before insertion or 2 person bag-valve-mask ventilation using a viral filter and a tight mask seal
- Hypotension
 - Establish IV access and administer fluid bolus
 - → [D03: Vascular Access](#)
- Refer to [Post-Arrest Checklist](#)

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Oxygenation and ventilation
 - Consider intubation early if not already done
 - Target SpO₂ to 92%-98%
 - End tidal CO₂ monitoring (EtCO₂): 35-45 mmHg
- Hypotension
 - Push dose [EPINEPHrine](#)
 - Target systolic blood pressure > 90 mmHg
 - Target mean arterial pressure > 65 mmHg
- Dysrhythmia
 - Treat as per appropriate CPG
- Perform 12-Lead ECG (minimum 10 minutes post-ROSC)
 - → [PR16: 12-Lead ECG](#)
- Refer to [Post-Arrest Checklist](#)

Evidence Based Practice

Post-Cardiac Arrest Care

Supportive

- [Inotrope](#)
- [Antiarrhythmic - Class I \(Na⁺ channel blockers\)](#)
- [Optimal Trip Destination](#)

Neutral

- [Oxygen](#)
- [Oxygen-titrated](#)
- [Post-arrest cooling](#)
- [Post-Arrest Cooling \(CCT\)](#)
- [12-Lead ECG](#)

Against

References

1. Ambulance Victoria. Clinical Practice Guidelines: Ambulance and MICA Paramedics. 2018. [[Link](#)]
2. Callaway CW, et al. Part 8: Post-cardiac arrest care: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. 2015. [[Link](#)]
3. Stub D et al. Post cardiac arrest syndrome: A review of therapeutic strategies. 2011. [[Link](#)]

Practice Updates

- 2023-12-19: removed COVID-related restrictions

