

Clinical Summary

Minnesota Resuscitation Consortium Clinical Summary

Yannopoulos D, Bartos JA, Martin C, et al. Minnesota Resuscitation Consortium's Advanced Perfusion and Reperfusion Cardiac Life Support Strategy for Out-of-Hospital Refractory Ventricular Fibrillation. *Journal of the American Heart Association*. 2016;5e003732. 2016. Jun13;5(60).

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Purpose:

The primary purpose of this article was to describe the protocol and report the outcomes of patients during an initial three-month period of an advanced perfusion and reperfusion life support strategy designed to improve outcomes for patients with out-of-hospital refractory ventricular fibrillation/ventricular tachycardia (VF/VT).

Background:

Patients resuscitated from non-traumatic OHCA with refractory VF/VT arrests have a high prevalence of coronary artery disease (CAD) and therefore are likely to have an underlying reversible cause for their cardiac arrest.¹ More than half of those resuscitated will receive revascularization when taken to the cardiac catheterization laboratory (cath lab) regardless of ST elevation status on the post-resuscitation electrocardiogram (ECG)?

Refractory VF/VT is defined in this article as failure to achieve sustained return of spontaneous circulation after three (3) direct current (DC) shocks and intravenous/intraosseous administration of 300 mg of amiodarone.

Methods:

- Three emergency medical services systems in the Minneapolis-St. Paul area participated in the protocol.
- Inclusion criteria include:
 - Out-of-hospital (OHCA) with presumed cardiac etiology cardiac arrest
 - First presenting rhythm was shockable
 - Age 18-75 years
 - Received at least 3 shocks without sustained return of spontaneous circulation (ROSC)
 - Lund University Cardiac Arrest System (LUCAS® chest compression system) with impedance threshold device (ITD) applied
 - Amiodarone 300 mg given
 - Transfer time from scene to cardiac cath lab of ≤ 30 minutes

Results:

- Of the 27 patients transported to the emergency department with mechanical chest compressions ongoing, 67% (18 patients) met the inclusion and exclusion criteria
- 83% (15 patients) received extracorporeal membrane oxygenation (ECMO)
- 3 patients had primary coronary intervention (PCI) with ongoing LUCAS chest compression system plus ITD, CPR and intra-aortic balloon pump (IABP)
- Of the 83% that received ECMO – 78% (14 patients) had significant coronary artery disease with a high degree of complexity and 67% (12 patients) received PCI
- Of the 12 patients receiving PCI, the mean number of stents placed per patient was 4±2
- 78% (14 patients) survived to hospital admission
- 55% (10 patients) survived to hospital discharge
- 50% (9 patients) with cerebral performance categories 1 & 2

Conclusions:

This study showed the Minnesota Resuscitation Consortium refractory VF/VT protocol is feasible and led to a high functionally favorable survival rate (55%) with very few complications. Characteristics associated with better outcomes were:

- Rapid EMS response time and shorter time from 911 call to delivery to the cath lab
- Bystander CPR
- Evidence of reversible coronary artery disease

Discussion Points:

- The definition of refractory VF/VT in this protocol was critical to the success of this protocol allowing for early identification of appropriate patients, mobilization of resources, and timely, safe transport to the cath lab.
- Manual CPR during transport can be dangerous for the EMS providers and most often not feasible.
- Another recent study reported the LUCAS device showed a 60% increase in blood flow to the brain in prehospital patients compared to manual CPR when measured by Doppler.³
- Mechanical CPR alleviates the danger to EMS providers and provides excellent cardiac and cerebral perfusion during transport.⁴
- Immediate transport of patients to the hospital for ECMO or direct to the cath lab for PCI with ongoing stabilized perfusion by mechanical CPR may be the best option to provide favorable functional outcomes.
- Studies have shown the successful ability to perform PCI with ongoing mechanical CPR versus initiating ECMO followed by PCI.^{4,5}
- ECMO (also termed ECPR) use for adult patients in cardiac arrest is increasing and in 2015 was added as a consideration by the American Heart Association for patients which:
 - traditional CPR methods failed
 - have a suspected reversible cause of cardiac arrest
 - a limited period of mechanical cardiopulmonary support is provided⁶
- Mechanical CPR is also being used for circulatory support during the ECMO cannulation process.
- These results demonstrated that a well-organized, multidisciplinary, and collaborative approach between EMS and hospital to treat refractory VF/VT patients can result in a significant improvement in neurologically intact survivors being discharged from the hospital. The LUCAS mechanical chest compression system was a critical component for success in this strategy and protocol.

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