Case Report: Intact Survival Following Prolonged Out-of-Hospital Cardiac Arrest Care

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CASE REPORT

A 57-year-old woman with a past medical history of diabetes, was found lying in bed and apneic by her partner, who activated 911. No bystander CPR was performed. An ambulance with two EMS providers, and a fire engine with three EMS providers, arrived on scene within 4 minutes of initial dispatch. The patient was found pulseless and apneic. Continuous manual compressions were performed by a single responder until a mechanical compression device was attached to the patient. The patient's airway was initially secured with an oropharyngeal airway (OPA) and ventilations administered via a bag-valve mask. The first electrocardiogram detected pulseless electrical activity. The OPA was removed in favor of successful placement of a laryngeal mask airway (LMA). Bag-valve ventilations were continued with high-flow oxygen.

After an unsuccessful IV attempt, an intraosseous (IO) device was used to establish access in the right humeral head and 1 milligram of epinephrine 1;10,000 was administered via IO push. A full cycle of CPR was performed and a second rhythm check detected ventricular fibrillation. A shock was delivered at 120 joules, bi-phasic, and an additional milligram of epinephrine was administered via IO push. The third rhythm check showed ventricular fibrillation and an additional shock was delivered at 150 joules, bi-phasic. Epinephrine and CPR were continued per ACLS protocols.

After 30 minutes of unsuccessful on-scene resuscitation EMS crews moved the patient via bag stretcher while the mechanical compression device continued chest compressions. EMS crews transferred care to emergency department personnel with CPR in progress 42 minutes after initial patient contact.

Upon arrival to the ED, the patient was without spontaneous respirations, and remained pulseless. Her pupils were fixed and dilated. The patient was intubated via direct laryngoscopy. The patient was noted to have a wide complex tachycardia without pulses. Defibrillation was attempted but unsuccessful. CPR was continued while the patient received lidocaine 100 mg, calcium gluconate 1g, insulin 10 units IV, and D50 IV. Amiodarone was subsequently administered, along with magnesium sulfate 1g IV. Return of spontaneous circulation (ROSC) was achieved but subsequently lost approximately 63 minutes after initial EMS-patient contact. CPR was continued and the patient was next started on dopamine followed by norepinephrine. ROSC was re-achieved.

The patient's initial EKG showed a wide complex junctional rhythm with a rate of 75. Subsequent EKGs demonstrated a sinus tachycardia with a narrowed QRS complex and a RBBB. A bedside echocardiogram demonstrated no significant wall motion abnormality, no RV dilation, no pericardial effusion, and no evidence of pulmonary hypertension. A chest x-ray confirmed endotracheal tube placement and demonstrated pulmonary edema. Initial laboratory studies revealed an elevated creatinine (1.78 mg/dl) and glucose (485 mg/dl), and an anion gap of 19. The patient's wbc was 14,000, with 7% bandemia.

Additional history from the family revealed a prior hospital presentation for hypercalcemia, a recent thyroidectomy, and concern for parathyroid complications. The family also reported that the patient had been experiencing 2-3 days of severe diarrhea. Due to the severity of illness and recent surgical history, the patient was transferred to a tertiary care center via a critical care transport team.

During transport and at the tertiary care center, the patient became more alert, requiring sedation and analgesia, while the patient's blood pressure was tenuous and she received push-dose administration of epinephrine and titration of vasopressors. A CT scan of the chest and abdomen was negative for pulmonary embolism, but did demonstrate several rib fractures and a Thoracic vertebral fracture. Laboratory studies revealed mild hypokalemia and hypercalcemia. The patient was transferred to the Intensive Care Unit. A subsequent MRI did not show any cord signal abnormality.

DISCUSSION

High quality CPR encompasses five key components: Minimizing interruptions in chest compressions, providing compressions of adequate rate and depth, avoiding leaning on the chest between compressions and avoiding excessive ventilation. A recent study[1] comparing on scene to transport chest compressions revealed that compressions during transport are significantly worse than on scene compressions. In an effort to enhance prehospital resuscitative efforts and improve survival from out-of-hospital cardiac arrest (OHCA) the RI Department of Health, Center for EMS, in conjunction with the RI Ambulance Service Advisory Board, updated the cardiac arrest protocol reflecting these priorities.

In March 2017 the RI Department of Health released new protocols[2] requiring EMS providers to remain on scene for

30 minutes for both witnessed and unwitnessed OHCA. This was prompted by the evidence supporting worsened outcomes with interruptions in compressions[3] which are associated with a decrease in coronary and cerebral perfusion pressures requiring up to a minute of continuous compressions to achieve sufficient perfusion pressures. By remaining on scene, EMS providers are able to focus on resuscitative efforts such as early epinephrine administration, airway management and most importantly, minimally interrupted CPR as opposed to focusing on packaging and transporting the patient to the hospital. The duration of scene time was determined through a literature search, showing cases of successful OHCA management with ROSC after long field resuscitation.[4]

As part of ongoing quality improvement efforts, data were collected (some presented in this journal) to better understand the impact of the RI EMS Protocol changes.[5] Prior to these protocol changes, standard practice was to "scoop and run" with OHCA patients. This generated some resistance to remaining on scene for an extended time, largely based upon the potential for increased resource utilization and need for mutual aid in busy systems. Public perception surrounding OHCA care was likely a major factor in this as well.

During the implementation phase excessive attention remained on the actual time on scene; however, as EMS providers became more comfortable with the protocol, the focus shifted to strategies to minimize interruptions in compressions and deliver high quality CPR. This "pit crew" approach to OHCA,[6] adopted in numerous EMS systems nationally, where providers treat patients aggressively at the site of collapse, has been associated with improved patient outcomes and increased rates of ROSC.[6-8]

Public and provider education, engagement of major stakeholders and engaged medical direction are key factors in implementation of protocols such as the "30-minute CPR protocol." As we move forward and collect prospective data we anticipate that a specific time requirement on scene may be enhanced by a protocol to resuscitate most OHCA on scene until ROSC or futility is achieved.

CASE CONCLUSION

In the MICU the patient was weaned from vasopressors and was eventually extubated on hospital day 5, and placed in a brace for her spinal fracture. She required extensive Physical and Occupational Therapy, and was discharged on hospital day 25 to a skilled nursing facility. At the time of discharge, she was noted to have some mild cognitive deficits versus delirium of hospitalization. She was evaluated by cardiology and felt not to be a candidate for Automated Implantable Cardioverter Defibrillator placement, as there was little evidence her cardiac arrest was cardiogenic in nature. Based upon her most recent visits, we infer her Pittsburgh Cerebral Performance Category[9] (CPC) to be 2 – *Moderate disability but independent in activities of daily living.*

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