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Case Report

Prehospital anesthesia-led resuscitation during traumatic cardiac arrest following prolonged extrication: a case report

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Abstract

Background: Traumatic cardiac arrest during prolonged extrication presents significant physiologic challenges. While prehospital care traditionally relies on emergency medical services personnel, select systems deploy hospital-based teams capable of delivering advanced anesthetic and resuscitative interventions at the scene. Reports describing surgeon–Certified Registered Nurse Anesthetist (CRNA) mobile response teams in the United States remain limited.

Case Presentation: A 44-year-old male sustained a 60-foot fall with prolonged entrapment and bilateral lower extremity crush injuries. He was conscious initially but developed traumatic cardiac arrest during extrication following an additional 10-foot fall. A hospital-based mobile trauma team composed of a CRNA and a surgeon initiated definitive airway management, mechanical cardiopulmonary resuscitation, intraosseous and intravenous access, vasoactive therapy, metabolic resuscitation (calcium and bicarbonate), and prehospital blood transfusion. Return of spontaneous circulation was achieved after approximately nine minutes. Persistent shock required continued transfusion and resuscitative endovascular balloon occlusion of the aorta (REBOA) upon hospital arrival. Imaging demonstrated craniocervical dissociation with absent cerebral arterial flow. Injuries were deemed nonsurvivable.

Conclusion: This case demonstrates that hospital-level interventions can be successfully delivered in the prehospital setting by a surgeon–CRNA response team. Although the injury was ultimately fatal, early advanced resuscitation restored spontaneous circulation and permitted definitive diagnostic evaluation in the hospital. Mobile trauma teams may bridge the gap between prehospital and in-hospital care in select high-acuity scenarios.

Keywords: Prehospital anesthesia, Traumatic cardiac arrest, Crush injury, Hemorrhagic shock, REBOA, Trauma resuscitation

Key Clinical Message

Early, advanced prehospital resuscitation during a prolonged extrication enabled return of spontaneous circulation after traumatic cardiac arrest. This case report illustrates the value of integrated field deployment, coordinated extrication, and use of advanced interventions such as blood products, REBOA, and mechanical CPR in severe trauma.

Introduction

Traumatic cardiac arrest differs from medical cardiac arrest in both etiology and management. Hypoxia, hypovolemia, and obstructive shock are the predominant causes, and survival is dependent upon immediate correction of these reversible conditions rather than conventional cardiac life support measures. Early airway control, hemorrhage management, and rapid resuscitation are critical [1]. Most prehospital systems are limited to paramedic-level interventions. However, some systems deploy hospital-based teams capable of performing advanced airway management, blood product

administration, and resuscitative endovascular balloon occlusion of the aorta (REBOA) placement, all of which are traditionally initiated after arrival at a trauma center [2,3]. While physician-staffed helicopter Emergency Medical Services (EMS) have been described internationally, reports describing a surgeon–CRNA hospital-based ground/air response team performing hospital-level resuscitation in the United States remain limited [2,3]. This case highlights the physiological impact and clinical role of early advanced resuscitation during prolonged entrapment and traumatic cardiac arrest.

Patient Information

A 44-year-old male fell approximately 60 feet while performing tree work and had prolonged entrapment with bilateral lower extremity crush injuries. On initial EMS contact, the patient was conscious, oriented, and speaking in full sentences. He was suspended and pinned across the torso with bilateral lower extremity crush injury and suspected vascular compromise of the right leg. Full vital signs could not be obtained due to limited access. However, the patient was perfusing and interactive, indicating the presence of spontaneous circulation.

During extrication and movement, the patient acutely lost consciousness and pulse. Cardiopulmonary Resuscitation (CPR) was immediately started. The hospital-based trauma team composed of a surgeon and a CRNA arrived shortly after arrest and assumed responsibility for care and resuscitation. A rapid sequence intubation was performed by the CRNA to secure the airway, to treat hypoxia, and to enable controlled ventilation during transport. Mechanical CPR was initiated. Both intraosseous access and large-bore intravenous access were obtained in the field. The patient received epinephrine, sodium bicarbonate, and calcium chloride. There were concerns that the patient suffered crush injuries which raised concern for hyperkalemia and metabolic acidosis. Therefore, calcium was administered for membrane stabilization and sodium bicarbonate to treat severe acidosis. It was suspected that the patient was in hemorrhagic shock, and packed red blood cells were administered. After approximately nine minutes of advanced resuscitation, the end-tidal CO_2 rose to 37 mmHg, a pulse was palpated, and the monitor showed sinus tachycardia with a heart rate of 112 and a blood pressure of 43/29 mmHg. The patient remained hypotensive, a pelvic binder was placed, and vasopressors and additional blood products were infused during helicopter transport to the trauma center. Upon arrival at the trauma resuscitation unit, less than two hours after the team had arrived at the scene, the patient was mechanically ventilated, with a noninvasive blood pressure reading of 75/56 mmHg, a heart rate of 123 beats per minute, an end-tidal carbon dioxide reading of 34 mmHg, a core body temperature of 36.2°C, and an undetectable SpO2 reading. His peripheral pulses were +1 and thready in his bilateral lower extremities. A massive transfusion protocol was implemented, and a resuscitative endovascular balloon occlusion of the aorta (REBOA) device was placed via the left femoral artery to augment coronary and cerebral perfusion, and the patient's mean arterial pressure increased to 65 mmHg. A Computed Tomography (CT) Scan showed that the patient had craniocervical dissociation with absent cerebral arterial flow. This injury represents complete ligamentous separation of the skull from the cervical spine and is considered universally fatal without immediate surgical stabilization. Given the nonsurvivable injuries, resuscitative efforts were withdrawn and comfort care was provided.

Discussion

This case describes how anesthesia-directed resuscitation can alter a patient's physiology even in traumatic arrest. Restoration of spontaneous circulation resulted from correction of the major causes of traumatic arrest. The patient's hypoxia was treated with definitive airway as traumatic arrest is frequently associated with hypoxia and inadequate ventilation, and early definitive airway control improves resuscitation conditions and facilitates transport [4]. His hypovolemia was treated with transfusion of blood products due to suspected hemorrhagic shock. It has been shown that early resuscitation improves outcomes in severe trauma [5]. Additionally, early balanced resuscitation in trauma has been associated with improved survival compared with crystalloid-dominant resuscitation [5]. Crush injury and prolonged entrapment raised concern for severe hyperkalemia and metabolic acidosis, providing the rationale for calcium and bicarbonate administration. This case demonstrates the clinical impact of delivering advanced resuscitation at the scene of injury rather than after hospital arrival. The patient experienced traumatic cardiac arrest during extrication, a condition historically associated with extremely poor survival. However, rapid airway control, blood transfusion, correction of metabolic derangements, and circulatory support resulted in ROSC. Traumatic arrest differs fundamentally from medical cardiac arrest. The primary etiologies are hypoxia, hypovolemia, and obstructive shock rather than primary dysrhythmia. Therefore, interventions such as airway control, hemorrhage control, and transfusion are more important than traditional advanced cardiac life support algorithms [1]. The presence of a CRNA enabled immediate advanced airway management and pharmacologic resuscitation, interventions typically delayed until the patient arrives at the hospital. International physician-staffed prehospital systems demonstrate improved airway management success and stabilization [4,6,7]. This case supports translation of ICU-level resuscitation to the field, gaining time to bring the patient to a higher level of care. In fact, Morrison *et al.* [8] showed that REBOA use augments central perfusion and maintains coronary and cerebral perfusion during shock, and in this case, mean arterial pressure did improve. Although the neurologic injury sustained by the patient was nonsurvivable, the return of spontaneous circulation in the field permitted transfer to the hospital for a definitive diagnosis and prevented a premature termination of care. As this is a single case, it cannot establish outcome benefit. Individual contributions of airway management, transfusion, and metabolic correction cannot be isolated. In this instance, the patient's injury severity prevented survival assessment.

Conclusion

Early anesthesia-directed resuscitation in the prehospital environment restored spontaneous circulation in a patient with traumatic cardiac arrest. Although the patient's injury was nonsurvivable, ROSC demonstrated restoration of perfusion sufficient to allow diagnostic evaluation. The goal of resuscitation in traumatic arrest is not simply survival but identification of salvageable injuries. Without prehospital advanced intervention, this patient would likely have been pronounced at the scene.

Ethics Statement

This report was prepared in accordance with the CARE case-report guidelines [9]. The patient did not survive, and no identifiable information is included. Institutional review determined formal

consent was not required for publication of a de-identified case report.

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