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Case Report

Lazarus phenomenon in trauma

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ABSTRACT

Lazarus phenomenon embodies auto-resuscitation, aka the return of spontaneous circulation following termination of cardiopulmonary resuscitation. Limited or no literature exists that describes auto-resuscitation in trauma. In the current report, we describe a case of an older woman that presented with poly-traumatic injuries following a motor vehicle collision. The aggressive resuscitation efforts failed, and the patient witnessed a pulseless electrical activity; however, nine-minutes after cessation of resuscitation efforts, the patient experienced auto-resuscitation. In addition to the sequel of events following the presentation, the report highlights the management dilemma and ethical implications relating to the observation period for auto-resuscitation in cases of donation after circulatory death, where the urgency to harvest the organs to ensure maximum viability is in direct opposition to ensuring enough time has elapsed to rule out auto-resuscitation. Guidelines on an appropriate period for observation in auto-resuscitation patients queued for organ donation are warranted, keeping in lieu viability of organs following death.

Introduction

The "Lazarus Phenomenon" embodies the process of autoresuscitation and refers to the return of spontaneous circulation (ROSC) following cessation of cardiopulmonary resuscitation (CPR) [1,2]. Coined by Bray in a biblical reference to *Lazarus*, who was resurrected from the dead, it is often described in association with non-traumatic events such as acute coronary syndrome, cardiac dysrhythmias, pulmonary embolism, metabolic derangements, etc. [3] The occurrence of *Lazarus* phenomenon in trauma is rare. The current report describes a case of *Lazarus* phenomenon in an elderly female involved in a motor vehicle collision (MVC) and discusses the potential ethical/moral implications that physicians in acute care settings should be made aware.

Case report

A 79-year-old Caucasian woman was referred to our Level-I trauma center for management of multiple injuries following an MVC that occurred an hour before presentation. Medical history was significant for atrial fibrillation, hypertension, coronary artery disease, and hyperlipidemia. Before arrival at our center, initial evaluation at an outside hospital noted bilateral pneumothoraces, closed fractures involving multiple ribs and the proximal femur on the right, abrasions with ecchymosis and a left renal laceration. Despite

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aggressive resuscitation, the systolic blood pressure (SBP) and Glasgow Coma Scale (GCS) score dropped to 90 mmHg and 14, respectively, which led to transfer to our center for higher care.

Upon arrival at our center (2 h after MVC, which includes a 15-minute transit time), no change was noted in her orientation (GCS still 14). Ongoing blood transfusions initiated at the referring hospital stabilized her BP at 95/70 mmHg, heart rate (HR) at 99 beats/min, respiratory rate (RR) 24 cycles/min, with 100% oxygen saturation (SpO_2). Primary trauma survey noted intact airway, breathing and circulation, and routine labs were ordered. Cranial/cervical spinal injuries were ruled out. The patient was neurovascularly intact.

Ten minutes since arrival, rapid sequence intubation with etomidate and rocuronium was performed. Drop-in BP (64/38 mmHg), and HR (83 beats/min) occurred. Out of concern that the previously inserted right-sided chest tube was now nonfunctional, a second chest tube was secured ipsilaterally that resulted in an immediate rush of air and prompt drainage of 50 cc of blood. The patient remained hypotensive as IV fluid bolus and transfusion of red cells continued.

Five-minutes following chest tube insertion, the patient was noted to have pulseless electrical activity (PEA). Resuscitation, according to Advanced Cardiac Life Support (ACLS) guidelines, was initiated. After the initial 1-mg IV epinephrine, she developed ventricular fibrillation. Despite continued resuscitation efforts, the patient remained in PEA. Focused echocardiography confirmed no cardiac activity. Resuscitation efforts stopped after a total of 9 min. Five-minutes after termination, a repeat echocardiogram also noted no cardiac activity, and the family was informed of the patient's demise. Approximately nine-minutes after cessation of resuscitation, while performing post-mortem care, a registered nurse noted respiratory efforts, heard air movement through the now detached end of the endotracheal tube, and felt a strong radial pulse [HR 132 beats/min; BP 142/79 mmHg]. Her family was informed about the ROSC. Ten-minutes later, BP and HR decreased to 100/53 mmHg and 100beats/min, respectively. A peripheral epinephrine drip was initiated at 0.03 μg/kg/min.

Twenty-minutes following ROSC, BP fell to 83/40 mmHg and heart rate remained constant at 100beats/min. With a bolus of normal saline and an epinephrine drip, a rebound increase in BP (130/77 mmHg) was observed. The patient continued to remain hemodynamically unstable. Four-hours after ROSC, a pre-emptive selective coiling and arterial gel-foam embolization of the inferior renal pole, for a concerning local hematoma producing a tamponade effect, was performed. Resuscitation attempts continued. The INR improved from over 23 to 6.76. Acidosis continued to worsen with pH dropping to 7.12 before rebounding back to 7.2 again. By this time, 5 units of PRBCs, 4 units of FFP, 2 platelets concentrate, and 2 l of IV fluids were transfused. Her GCS continued to remain at 3 T with no observable neurological function including negative corneal reflexes. Ten-hours post auto-resuscitation, the patient developed asystole. The patient's family opted to not resuscitate, and the patient died.

Discussion

Our report describes the sequence of clinical events in an elderly woman with polytrauma that was associated with ROSC during management. Following a comprehensive review of literature, no reports on ROSC in acute traumatic events were retrieved. The ethical challenge was having to inform the patient's family of her demise, only to change the decision 10-min later to report a different outcome owing to ROSC. While such events elicit emotional burden on the family, it undoubtedly engenders false hope on a patients' survival and often may lead to doubts about the expertise/competence of the emergency response team responsible for patient care.

An important aspect of ROSC is the formulation of appropriate guidelines relating the observation period before declaration of death, especially in patients queued for organ donation. Knowledge of an appropriate consensus on waiting times for organ procurement may enhance transplant care. Updated recommendations for ROSC waiting periods for donation after cardiac death (DCD) ranges from 2 to 5 min [4,5], although older guidelines recommend waiting as long as 10 min [6]. This may be more appropriate since most documented ROSC occurred within 10 min following cessation of CPR in 82% of cases with a mean delay of 7–8 min [4]. For providers working in acute care settings, it is pertinent to be aware of the ethical/moral complications relating to the waiting period in cases of DCD, where the urgency to harvest the organs to ensure maximum viability is in direct opposition to ensuring enough time has passed to rule out ROSC.

Sheth et al. investigated the waiting period for ROSC for DCD [7]. In single-center series of 73 patients, majority of who suffered devastating brain injuries but not brain dead, the study noted that an observational period of only 2 min after asystole was entirely sufficient and that DCD efforts may be initiated promptly. However, there are no reports of ROSC in patients who did not receive CPR, contrary to Sheth and colleagues where patients underwent withdrawal of life-supporting care. Additionally, the mechanisms of death between uncontrolled cardiac death as seen in instances with CPR and continued partial perfusion, and controlled cardiac death, where life-saving measures are withdrawn, are clearly different [3]. Any discussion of a waiting period after uncontrolled cardiac death that includes the possibility of DCD must include the inherent ethical dilemma between waiting to see if AR occurs and the rush for organ procurement to maximize transplant organ viability. In an attempt to clear up the ethical argument of DCD, Shemie [8] recommends brain activity using cerebral blood flow as a surrogate marker as opposed to resumption of cardiac activity. [9] Any loss of blood flow to the brain greater than 20 s leads to some degree of permanent brain damage [10]. In the context of the *Lazarus* Phenomenon where there is cessation of cerebral blood flow for several minutes (9-min in our patient), severe and irreversible brain damage must have occurred.

Conclusions

Patients with autoresuscitation may pose a dilemma to physicians especially those queued for organ donations. With no validated guidelines on the observational period to rule out AR in cases of cardiac death, we recommend using a cutoff of 10-min with assessment of cardiac/cerebral perfusion prior to organ harvesting. Although the concept of AR is medically and scientifically intriguing, loss of cerebral perfusion beyond 20 s creates a permanent loss of brain activity and may adversely impact multi-organ functions. There have been documented efforts that autoresuscitation does not occur without CPR, and thus controlled DCD should not be as ethically controversial as it appears from a literature review.

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Declaration of competing interest

None of the authors listed on the manuscript have any potential conflict of interest to report.

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