International Journal of Innovative Research in Medical Science (IJIRMS)
Volume 10, Issue 02, February 2025,
*https://doi.org/10.23958/ijirms/vol10-i02/2036*

**Case Report**

# Lazarus Phenomenon: A Case of Spontaneous Return of Circulation After Failed Resuscitation in a Trauma Patient

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Received 21 January 2025; Accepted 15 February 2025; Published 21 February 2025

## Abstract

The Lazarus phenomenon, or auto-resuscitation, refers to the spontaneous return of circulation (ROSC) after failed cardiopulmonary resuscitation (CPR). First described in 1982, it remains rare and poorly understood, with clinical and ethical implications regarding death declaration and organ donation. Proposed mechanisms include pulmonary hyperinflation, delayed drug effects, myocardial stunning, and absent reflexive brainstem activity.

We present the case of a 71-year-old man admitted after cranial and thoracic trauma from a fall. He exhibited mild hypoxemia and confusion but suffered a cardiorespiratory arrest while awaiting further evaluation. CPR was initiated per Advanced Life Support (ALS) protocol. Cardiac tamponade was ruled out by bedside echocardiography. After 20 minutes of asystole with low capnography values, CPR was halted, and death was declared. Approximately one minute later, the patient spontaneously achieved ROSC but without respiratory drive. He was stabilized and transferred to the ICU. Imaging revealed subarachnoid hemorrhage, frontal bone and C7 fractures, and rib fractures, but no pneumothorax or hemothorax. Despite interventions, he ultimately died.

Possible mechanisms for ROSC include relief of intrathoracic pressure, delayed drug effects, and improved cerebral perfusion after cervical collar removal. This case highlights the need for caution in declaring death and further research into auto-resuscitation.

**Keywords:** ***Lazarus Syndrome, Cardiopulmonary Resuscitation, Spontaneous Return of Circulation, Traumatic Brain Injury, Critical Care.***

## Introduction

The Lazarus phenomenon, or autoresuscitation, is a rare but fascinating occurrence in which spontaneous return of circulation (ROSC) occurs after failed attempts at cardiopulmonary resuscitation (CPR). First reported in 1982, this phenomenon challenges our conventional understanding of death and has profound implications for clinical practice [1-3]. Very rarely reported, the phenomenon has been described in both adult and pediatric populations [2]. The underlying mechanisms of the Lazarus phenomenon remain poorly understood. Several hypotheses have been proposed, including hyperinflation of the lungs leading to increased intrathoracic pressure, delayed effects of medications, myocardial stunning following prolonged periods of ischemia and reflexive brainstem activity that may reactivate spontaneous circulation after cessation of resuscitation [1,3,4,5]. It has been suggested that the phenomenon may occur more frequently than reported, as some instances may go unnoticed due to insufficient post-CPR monitoring [1,2].

The phenomenon of autoresuscitation raises questions about when to definitively declare death and could potentially have implications in cases of organ donation where death is determination by circulatory criteria [2]. Research indicates that extending the monitoring period after cessation of resuscitative efforts may help detect instances of autoresuscitation [1,3,6].

Given the complexity of this phenomenon and its implications for clinical practice, further investigation into the mechanisms, predictive factors, and appropriate monitoring after termination of resuscitation is essential. This case serves as a crucial reminder of the need for cautious and extended monitoring in similar scenarios to prevent premature declarations of death.

## Case Description

We present the case of a 71-year-old-male who presented to the emergency department after suffering head and thoracic trauma due to a fall from a height of three meters. Upon hospital admission the patient was described as having mild resting hypoxemia (needing supplemental oxygen by nasal canula at a rate of 3 litres per minute), a Glasgow Coma Scale (GCS) score of 14 due to being confused and as having neck pain despite no neurological deficits. While awaiting blood work and whole-body Computed Tomography (CT) scans the

patient suffered a cardiac arrest. Immediate CPR was initiated as per as per American Heart Association Guidelines' Advanced Life Support (ALS) protocol. During the 20 minutes of ALS, the patient presented non-shockable rhythm (asystole) and low capnography (parcial pressure of carbon dioxide mostly between 10 and 20 millimetres of mercury) despite an adequate ventilation volume. Cardiac tamponade was ruled out with point-of-care echocardiography. Upon consideration of the beforementioned facts, CPR was suspended, the ventilation bag was disconnected from the endotracheal tube and the cervical collar - which had been placed since before hospital admission - relieved. One minute death declaration, the patient autonomously recovered pulse but kept no respiratory drive. Ventilatory and vasopressor support was promptly initiated, and the patient admitted to an intensive care unit (ICU). The head and neck CT scans revealed subarachnoid haemorrhage with intraventricular extension as well as fractures of the frontal bone and C7 vertebra. Thorax CT-scan revealed rib fractures but no sign of haemothorax, pneumothorax nor pneumomediastinum. Abdomen CT scan did not reveal any major lesion. During admission in the ICU the patient did not recover neurological status - described as a GCS score of three, without sedation and absent of brainstem reflexes apart from respiratory stimulus - having been submitted to terminal extubation and died.

## Discussion

The case presented exemplifies a rare instance of spontaneous ROSC, contributing to the growing body of literature documenting this unexpected phenomenon.

Several mechanisms have been proposed to explain autoresuscitation, though none are fully understood. [1,3,4] Proposed mechanisms relevant to this case include hyperinflation-induced increased intrathoracic pressure - this patient had a consistently low capnography and ROSC occurred after disconnection of the ventilation bag, therefore despite the best efforts for maintaining a normal ventilation volume this mechanism cannot be ruled out, and decreased cerebral perfusion supressing brainstem reflexes - removal of the cervical collar may have alleviated any mechanical restrictions on circulation, contributing to better cerebral perfusion and therefore spontaneous initiation of brainstem reflexes - although contribution from delayed effect from medications - namely adrenaline - and myocardial stunning could have played a role.

This case also stresses the need for cautious decision-making when declaring death, particularly in trauma patients who present with complex, multifactorial causes of arrest. In this case, the ROSC after cessation of CPR following a 20-minute attempt, highlights the need for an extended post-CPR observation period, as suggested by recent literature [1,3,5,6].

Recovery is highly variable. In this clinical case, both the low-flow time and the injuries sustained from the fall conditioned the neurological prognosis.

## List of Abbreviations

ALS: Advanced Life Support

AHA: American Heart Association

CPR: Cardiopulmonary Resuscitation

CT: Computed Tomography

GCS: Glasgow Coma Scale

ICU: Intensive Care Unit

ROSC: Return of Spontaneous Circulation

mmHg: Millimeters of Mercury (unit of pressure)

## Declarations

## Ethics Approval and Consent to Participate

All the procedures and medical exams that the patient was subjected to diagnose and treat the above condition was consented by the patient.

Consent to report the case and all clinical data in medical journals and scientific meetings was obtained by the patient.

Due to the nature of the article, the approval of the Hospital's Ethical Committee was deemed not applicable.

## Data Availability

All the data is available on hospital records and can be obtained by contacting the corresponding author.

## Funding Statement

No funding was received.

## Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

## Authors' contributions

FPDAB: Work conception and design, data acquisition, analysis, and interpretation, work drafting, critical review, approval of the final version of the manuscript.

AA: Work conception, data acquisition, analysis, and interpretation, critical review, approval of the final version of the manuscript.

JC: Work conception, data acquisition, analysis, and interpretation, critical review, approval of the final version of the manuscript.

IP: Work conception, data acquisition, analysis, and interpretation, critical review, approval of the final version of the manuscript.

JG: Work conception, data acquisition, analysis, and interpretation, critical review, approval of the final version of the manuscript.

AF: Work conception, data acquisition, analysis, and interpretation, critical review, approval of the final version of the manuscript.

All authors approved the final version to be published.

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