

# Push to Pulse: Resuscitation of a Patient in Hemorrhagic Shock - A Case Report

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**Abstract:** ***Background:** Intraoperative hemorrhagic shock due to accidental vascular injury is a rare but potentially fatal perioperative complication. Rapid identification and immediate resuscitation guided by established protocols are essential for patient survival. **Case Presentation:** We report the case of a 32-year-old male who sustained catastrophic hemorrhage following inadvertent transection of the femoral artery during surgical debridement of an infected amputation stump. Blood loss of approximately 2.5 litres led to hemorrhagic shock and subsequent cardiac arrest. Immediate Cardiopulmonary Resuscitation (CPR) following the AHA Advanced Cardiovascular Life Support (ACLS) algorithm achieved Return of Spontaneous Circulation (ROSC) within four minutes. Post-resuscitation care, emergency femoral artery ligation, and intensive care unit management resulted in haemodynamic stabilisation. **Conclusion:** This case underscores the life-saving value of prompt, guideline-based resuscitation, multidisciplinary teamwork, and adherence to ATLS principles for fluid and blood product replacement in perioperative hemorrhagic emergencies.*

**Keywords:** Hemorrhagic shock; cardiac arrest; cardiopulmonary resuscitation (CPR); return of spontaneous circulation (ROSC); ACLS; ATLS; femoral artery injury; perioperative emergency; intraoperative hemorrhage; epinephrine; multidisciplinary resuscitation

## 1. Introduction

Resuscitation encompasses a continuum of medical interventions designed to restore vital physiological functions in patients who have experienced life-threatening events such as cardiac arrest, respiratory failure, or severe hemorrhagic trauma. The spectrum of resuscitation ranges from Basic Life Support (BLS)- involving cardiopulmonary resuscitation (CPR) and automated external defibrillation- to Advanced Life Support (ALS), which incorporates pharmacological therapy, definitive airway management, and cardiac rhythm monitoring conducted by trained healthcare professionals.

Compression-Only Life Support (COLS), also known as cardiopulmonary resuscitation without rescue breaths, represents an important adjunct in out-of-hospital cardiac arrest scenarios, particularly when rescuers lack formal CPR training. Evidence supports its use by bystanders as it sustains some degree of coronary and cerebral perfusion until advanced help arrives. The primary goals of resuscitation are to maintain oxygen delivery to vital organs, re-establish spontaneous cardiac output, limit post-arrest organ dysfunction, and optimise neurological recovery.

Intraoperative vascular injury leading to massive hemorrhage and cardiovascular collapse is an uncommon yet highly lethal perioperative event. Accidental damage to major vessels- such as the femoral artery- can cause rapid, voluminous blood loss that overwhelms the patient's haemostatic and compensatory mechanisms, triggering hemorrhagic shock and cardiac arrest. Management requires immediate parallel actions: aggressive resuscitation and definitive surgical haemostasis.

This case report presents the successful management of a patient who experienced catastrophic intraoperative hemorrhage from an inadvertently transected femoral artery during orthopedic debridement, resulting in cardiac arrest. The case illustrates the critical role of immediate CPR, structured ACLS-based resuscitation, and effective multidisciplinary collaboration in achieving a life-saving outcome.

## 2. Methodology

### 2.1 Patient Profile

The patient was a 32-year-old male with a history of above-knee amputation performed for an open femoral shaft fracture, who subsequently developed an infected amputation stump requiring surgical debridement. Preoperative assessment confirmed cardiovascular parameters within normal limits, with the sole abnormality being a haemoglobin level of 8.4 g/dL, indicating mild-to-moderate anaemia. No significant cardiac, pulmonary, or renal comorbidities were identified.

### 2.2 Preoperative Anaesthetic Assessment

Standard preoperative evaluation included airway assessment, cardiovascular stability review, and laboratory investigation. American Society of Anesthesiologists (ASA) standard monitoring was applied. The planned anaesthetic technique was Combined Spinal-Epidural (CSE) anaesthesia, administered using Injection Bupivacaine Heavy 0.5%. The patient was deemed suitable for surgery, with appropriate consent obtained and emergency equipment confirmed to be available.

### 2.3 Intraoperative Incident

During the debridement procedure, the femoral artery was accidentally transected, precipitating an acute haemorrhage of approximately 2.5 litres. The resulting hypovolaemia caused rapid cardiovascular decompensation, leading to hemorrhagic shock and cardiac arrest. The operating team immediately recognised the clinical emergency and activated the resuscitation protocol.

### 2.4 Resuscitation Protocol

Immediate Cardiopulmonary Resuscitation (CPR) was initiated in strict accordance with the AHA ACLS guidelines. The following interventions were executed concurrently:

- High-quality, uninterrupted chest compressions were commenced without delay. Compression rate was maintained at 100–120/min with depth 5–6 cm, ensuring full recoil and minimal interruptions.
- Intravenous Epinephrine was administered as per the ACLS vasopressor algorithm. Epinephrine (1 mg IV) was administered every 3–5 minutes in accordance with current AHA ACLS guidelines.
- The airway was secured with an endotracheal tube (size 8); controlled mechanical ventilation was initiated.
- Chest compressions were delivered in continuous two-minute cycles with intermittent cardiac rhythm assessment.
- Massive transfusion protocol and aggressive intravenous fluid resuscitation were initiated simultaneously to address the hemorrhagic aetiology.

## 3. Results and Discussion

### 3.1 Resuscitation Outcome

Return of Spontaneous Circulation (ROSC) was achieved within four minutes of initiating CPR — a clinically significant outcome that reflects the effectiveness of timely, guideline-concordant resuscitation. Early ROSC is strongly associated with improved neurological function and overall survival, and the four-minute interval achieved in this case falls within the window considered optimal for limiting hypoxic organ injury.

### 3.2 Post-Resuscitation Management

Following ROSC, the patient was maintained on assist-control mechanical ventilation at a respiratory rate of 16 breaths per minute, with SpO<sub>2</sub> sustained at 99% and PaCO<sub>2</sub> at 45 mmHg — values indicative of effective ventilatory control. Mean arterial pressure was kept between 65 and 70 mmHg using inotropic support and blood product replacement, consistent with post-cardiac arrest haemodynamic targets. Intraoperative arterial blood gas (ABG) analysis revealed mild metabolic acidosis, an expected sequela of the transient global hypoperfusion during cardiac arrest.

### 3.3 Surgical Haemostasis

Emergency ligation of the femoral artery was performed by a Cardiovascular and Thoracic Surgeon (CVTS) to achieve

definitive haemostasis. Once the patient was haemodynamically stable, he was transferred to the Surgical Intensive Care Unit (SICU) for ongoing monitoring and organ support.

### 3.4 Discussion

This case illustrates the convergence of multiple risk factors—pre-existing anaemia, complex surgical anatomy from prior amputation, and an infected operative field— that created conditions predisposing to catastrophic vascular injury. The baseline haemoglobin of 8.4 g/dL substantially reduced the patient's physiological reserve, rendering him particularly vulnerable to the haemodynamic consequences of rapid blood loss.

The decisive factor in this patient's survival was the immediate initiation of CPR. Adherence to the AHA ACLS algorithm — encompassing uninterrupted high-quality chest compressions, timely epinephrine administration, and prompt advanced airway management— directly enabled ROSC within four minutes. This aligns with the robust body of evidence confirming that early, guideline-concordant CPR is the strongest predictor of cardiac arrest survival, with each minute of delay reducing the likelihood of ROSC by approximately 10%.

Critically, the multidisciplinary team response was seamless. The anaesthetic team, surgical team, cardiovascular surgeon, and ICU personnel worked in synchrony, ensuring that resuscitation of the circulation and surgical control of haemorrhage occurred in parallel rather than sequentially. In hemorrhagic cardiac arrest, controlling the source of bleeding is as urgent as restoring cardiac output; this case exemplifies that principle.

The mild metabolic acidosis identified on post-ROSC ABG analysis reflects the expected physiological consequence of the arrest period and reinforces the importance of targeted post-resuscitation care. Correction of metabolic derangements, optimisation of oxygen delivery, and prevention of secondary organ injury are integral to the post-cardiac arrest care bundle and were appropriately addressed in this case.

## 4. Conclusion

This case demonstrates that survival from intraoperative hemorrhagic shock and cardiac arrest is achievable when resuscitation is initiated immediately, executed precisely, and supported by coordinated multidisciplinary care. The four-minute attainment of ROSC through strict AHA ACLS protocol adherence was the pivotal determinant of this patient's outcome.

Adherence to ATLS principles for fluid and blood product resuscitation, timely surgical control of hemorrhage via femoral artery ligation, and structured post-resuscitation intensive care collectively sustained the physiological recovery initiated by CPR. This case reinforces that intraoperative emergencies demand not only clinical competence but also psychological preparedness and team cohesion.

Healthcare institutions should prioritise simulation-based training and regular multidisciplinary emergency drills to ensure that surgical and anaesthetic teams are equipped to manage such high-stakes, rapidly evolving intraoperative crises with the speed and precision this case required.

## References

- [1] Panchal AR, Bartos JA, Cabanac JG, et al. Part 3: Adult Basic and Advanced Life Support — 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2020;142(16 Suppl 2): S366–S468.
- [2] American College of Surgeons Committee on Trauma. *Advanced Trauma Life Support (ATLS) Student Course Manual*. 10th ed. Chicago, IL: American College of Surgeons; 2018.
- [3] Kleinman ME, Goldberger ZD, Rea T, et al. 2017 American Heart Association Focused Update on Adult Basic Life Support and Cardiopulmonary Resuscitation Quality. *Circulation*. 2018;137(1):e7–e13.
- [4] Perkins GD, Graesner JT, Semeraro F, et al. European Resuscitation Council Guidelines 2021: Executive Summary. *Resuscitation*. 2021; 161: 1–60.
- [5] Morrison LJ, Neumar RW, Zimmerman JL, et al. Strategies for improving survival after in-hospital cardiac arrest in the United States. *Circulation*. 2013;127(14):1538–1563.
- [6] Rossaint R, Bouillon B, Cerny V, et al. The European guideline on management of major bleeding and coagulopathy following trauma: fifth edition. *Crit Care*. 2016;20(1):100.
- [7] Nolan JP, Soar J, Cariou A, et al. European Resuscitation Council and European Society of Intensive Care Medicine 2015 guidelines for post-resuscitation care. *Intensive Care Med*. 2015;41(12):2039–2056.
- [8] Link MS, Berkow LC, Kudenchuk PJ, et al. Part 7: Adult Advanced Cardiovascular Life Support — 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation. *Circulation*. 2015;132(18 Suppl 2): S444–S464.
- [9] Soar J, Nolan JP, Bottiger BW, et al. European Resuscitation Council Guidelines for Resuscitation 2015: Section 3. Adult Advanced Life Support. *Resuscitation*. 2015; 95: 100–147.
- [10] Haas T, Fries D, Tanaka KA, et al. Usefulness of standard coagulation tests and measurement of non-activated clotting time in critically ill patients. *Br J Anaesth*. 2015;114(2):217–224.
- [11] Myburgh JA, Mythen MG. Resuscitation fluids. *N Engl J Med*. 2013;369(13):1243–1251.
- [12] Spahn DR, Bouillon B, Cerny V, et al. Management of bleeding and coagulopathy following major trauma: an updated European guideline. *Crit Care*. 2013;17(2): R76.
- [13] Sunde K, Pytte M, Jacobsen D, et al. Implementation of a standardised treatment protocol for post resuscitation care after out-of-hospital cardiac arrest. *Resuscitation*. 2007;73(1):29–39.
- [14] Shoemaker WC, Appel PL, Kram HB. Role of oxygen debt in the development of organ failure, sepsis, and death in high-risk surgical patients. *Chest*. 1992;102(1):208–215.
- [15] Gaieski DF, Band RA, Abella BS, et al. Early goal-directed hemodynamic optimization combined with therapeutic hypothermia in comatose survivors of out-of-hospital cardiac arrest. *Resuscitation*. 2009;80(4):418–424.
- [16] Panchal AR, Berg KM, Hirsch KG, et al. 2023/2024 AHA Focused Update on Adult Advanced Life Support. *Circulation*.