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CASE REPORT

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# Recurrent out-of-hospital cardiac arrest (OHCA) in the course of acute coronary syndrome (ACS) in a 43-year-old man: a case report

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## ABSTRACT

We report the case of a 43-year-old man with no known cardiac history who developed out-of-hospital cardiac arrest (OHCA) at home, with ventricular fibrillation (VF) as initial rhythm. Following immediate cardiopulmonary resuscitation (CPR) initiated by a bystander under telephone guidance, the emergency medical services (EMS) team provided advanced life support (ALS) in accordance with the 2025 European Resuscitation Council (ERC) guidelines. Multiple transient returns of spontaneous circulation (ROSC) were achieved, interspersed with recurrent cardiac arrest of different mechanisms. Electrocardiographic characteristics of acute coronary syndrome (ACS) were identified after ROSC, and targeted treatment of a potentially reversible cause of cardiac arrest was initiated. Particular emphasis is placed on the organisational aspects of care delivered by a three-person non-physician EMS crew. The operational context included prehospital management in a challenging environment, difficult patient extrication, and prolonged transport to a higher-level referral centre during ongoing resuscitation. These coordinated interventions were associated with short-term survival and allowed definitive in-hospital treatment.

**KEY WORDS**: Cardiac arrest, ventricular fibrillation, cardiopulmonary resuscitation, return of spontaneous circulation, acute coronary syndrome.

**Abbreviations**

ECG - electrocardiogram;
$ETCO_2$ - end-tidal carbon dioxide;
LUCAS® - mechanical chest compression device;
PEA - pulseless electrical activity;
VF - ventricular fibrillation;
ACS - acute coronary syndrome;
CPR - cardiopulmonary resuscitation;
ROSC - return of spontaneous circulation;
EMS - emergency medical services;
OHCA - out-of-hospital cardiac arrest;
CA – cardiac arrest.

## INTRODUCTION

Out-of-hospital cardiac arrest (OHCA) remains one of the major challenges in emergency medicine, and patient survival is strongly dependent on early bystander CPR and timely defibrillation in shockable rhythms such as ventricular fibrillation (VF). The European Resuscitation Council (ERC) guidelines emphasise minimizing interruptions in chest compressions, rapid rhythm recognition, and structured delivery of advanced resuscitation care [1].

Acute coronary syndrome (ACS) is one of the most common potentially reversible causes of cardiac arrest in adults. In patients with post-ROSC electrocardiographic evidence of myocardial ischemia, including elevation or equivalent patterns, early referral for invasive diagnostics and revascularisation constitutes a key component of definitive treatment. The recommendations of the European Society of Cardiology (ESC) highlight the need for rapid diagnosis, the implementation of an early invasive strategy, and individualised antithrombotic therapy based on clinical presentation and risk of bleeding.

End-tidal carbon dioxide ($ETCO_2$) monitoring during ALS is a valuable tool for assessing the quality of chest compressions, facilitating early detection of ROSC, and identifying hemodynamic deterioration suggestive of recurrent cardiac arrest. Guideline recommendations indicate that $ETCO_2$ values should be interpreted in conjunction with the overall clinical assessment and should not cause unnecessary interruptions in resuscitation efforts [2].

In the prehospital setting, organisational factors are also critical, including the size of the crew and the ability to perform parallel tasks such as chest compressions, capnography-guided ventilation, medication preparation and administration, ECG acquisition and transmission, and coordination of transport. In the Polish EMS system, both physician-staffed and nonphysician teams are operational, and team size may vary. In complex cases with recurrent OHCA and long transport times to a referral centre, a three-person crew may be crucial for maintaining adherence to guideline-recommended timeframes while minimising the risk of interruptions in chest compressions.

## CASE REPORT

**PATIENT INFORMATION:** The event occurred during a daytime EMS shift involving a three-paramedic crew, with the most experienced paramedic acting as the crew leader. At the time of dispatch, the entire team was already in the ambulance, resulting in a dispatch-to-departure interval of 18 seconds. The initial call was about sudden severe chest pain. During the response, the digital dispatch system was first updated with information indicating agonal respirations (*"gasping")* and shortly thereafter, with information that the bystander had recognised cardiac arrest and initiated CPR under dispatcher guidance. Table 1 presents the timeline of events based on the EMS documentation.

The patient was a 43-year-old man with no known cardiac history. On arrival at the emergency services, he was unconscious and apneic. Bystander CPR was in progress and was being performed by the patient's spouse. According to the witness, the patient had experienced abdominal pain and nausea since the morning, followed approximately one hour later by chest and back pain. During the emergency call, he suddenly lost consciousness and stopped breathing. Past history was unremarkable, with no known allergies, no chronic treatment, and no regular use of medications or supplements. On the day of the event, he had not eaten and had consumed only unsweetened tea.

**CLINICAL FINDINGS**: The EMS team was dispatched at 09:09:35, departed at 09:09:53, and arrived at the scene at 09:14:39. During the response, the crew received updated information indicating agonal respirations and dispatcher-assisted bystander CPR. The estimated time for the first cardiac arrest was 09:10:30. The initial rhythm evaluation confirmed ventricular fibrillation, and four defibrillations (200–360 J) were delivered before ROSC was achieved at 09:26:44. The 12-lead ECG demonstrated an elevation consistent with ACS/STEMI, and unfractionated heparin (5000 IU IV) was administered (Figure 1).

Recurrent VF (CA #2) occurred at 09:30:24 and was treated with defibrillation, resulting in ROSC at 09:32:26. This was followed by severe bradycardia (HR <40/min), requiring transcutaneous pacing initiated at 09:32:54 (rate 70/min; capture threshold 85 mA; $ETCO_2$ 30 mmHg). A subsequent decline in $ETCO_2$ led to a reassessment; pacing was briefly paused and pulseless electrical activity (CA #3) was identified at 09:34:14. ALS for a nonshockable rhythm was continued with repeated adrenaline administration. ROSC was re-established at 09:48:00 (HR 60/min; $SpO_2$ 92%; $ETCO_2$ 36 mmHg), and the transport was subsequently initiated. After arrival at the receiving hospital at 10:05:37, a further episode of cardiac arrest (CA #4, PEA) occurred at 10:06:45. Subsequent conversion to VF enabled defibrillation at 10:21:00, resulting in ROSC at 10:23:04 (HR approximately 65/min; $ETCO_2$ 32 mmHg; $SpO_2$ 86%). The patient was handed over for definitive in-hospital care at 10:34:20.

**TIMELINE**: Throughout the prehospital phase, four cardiac arrest episodes, four ROSC events, and six defibrillations were recorded. The EMS response time was 4 min 46 s, and the total prehospital time was approximately 56 minutes (Table 1).

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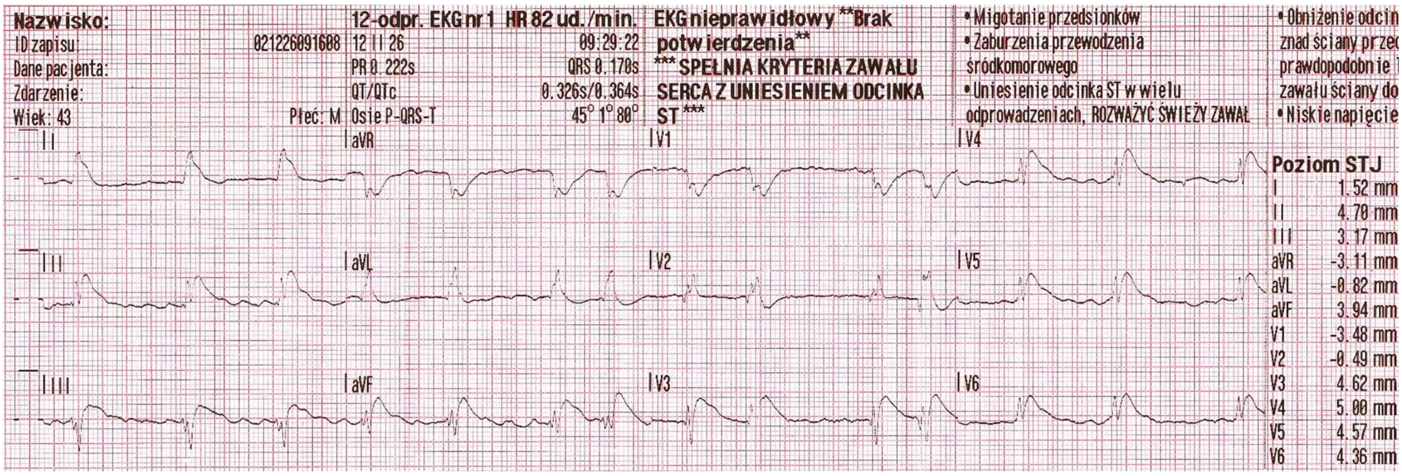


**Figure 1.** 12-lead ECG demonstrated an elevation consistent with ACS/STEMI.

**Table 1.** Timeline of events (based on EMS documentation).

| Time (12 Feb 2026) | Event | Notes |
|---|---|---|
| 09:09:35 | EMS dispatch assigned | Chief complaint: severe chest pain |
| 09:09:39 | EMS crew notified | — |
| 09:09:53 | EMS departure | Departure <30 s from notification |
| 09:10:30 | Estimated onset of CA #1 | Agonal respirations reported; dispatcher-assisted bystander CPR initiated |
| 09:14:39 | EMS arrival on scene | Response time <5 min |
| 09:16:56 | Defibrillation #1 (VF) | 200 J |
| 09:19:16 | Defibrillation #2 (VF) | 300 J |
| 09:21:24 | Defibrillation #3 (VF) | 360 J; amiodarone 300 mg IV + adrenaline 1 mg IV |
| 09:24:36 | Defibrillation #4 (VF) | 360 J |
| 09:26:44 | ROSC #1 | Palpable central pulses |
| 09:28:48 | Post-ROSC 12-lead ECG | Findings consistent with ACS/STEMI |
| 09:29:54 | Heparin administered | 5,000 IU IV |
| 09:30:24 | CA #2 (VF); defibrillation #5 | 360 J |
| 09:32:26 | ROSC #2 | Severe bradycardia (HR <40/min) |
| 09:32:54 | Transcutaneous pacing initiated | Rate 70/min; capture 85 mA; $ETCO_2$ 30 mmHg |
| 09:33:20 | Patient transferred to stretcher | Soft stretcher used |
| 09:33:51 | Decline in $ETCO_2$ → suspected recurrent CA | HR 65/min; $ETCO_2$ 26 mmHg |

| | | |
|---|---|---|
| 09:34:04 | Pacing paused for rhythm/pulse assessment | Electrical activity without palpable pulse |
| 09:34:14 | CA #3 (PEA) | Adrenaline 1 mg IV |
| ~09:36:00 | Transfer to ambulance; transport initiated | Continuous CPR using a mechanical chest compression device (LUCAS®), without interruptions |
| 09:37:19 | Persistent PEA | Adrenaline 1 mg IV |
| 09:41:29 | Persistent PEA | Adrenaline 1 mg IV |
| 09:45:44 | Persistent PEA | Adrenaline 1 mg IV |
| 09:48:00 | ROSC #3 | HR 60/min; $SpO_2$ 92%; $ETCO_2$ 36 mmHg |
| 09:48:00–10:05:37 | Post-ROSC transport | Continuous monitoring; ventilation; mechanical chest compression device (LUCAS®) on standby |
| 10:05:37 | Arrival at receiving hospital | deterioration of ETCO2 during transfer from the ambulance |
| 10:06:45 | CA #4 (PEA) | CPR with a mechanical chest compression device (LUCAS®); adrenaline 1 mg IV; ALS algorithm continued |
| 10:21:00 | Conversion to VF; defibrillation #6 | 360 J |
| 10:23:04 | ROSC #4 | HR ~65/min; $ETCO_2$ 32 mmHg; $SpO_2$ 86% |
| 10:34:20 | Patient handover | Interventional cardiology department |
| 10:48:29 | Mission completed | — |

**DIAGNOSTIC ASSESSMENT**: The prehospital diagnostic evaluation included repeated rhythm analysis during ALS and continuous $ETCO_2$ monitoring. Capillary blood glucose was 138 mg/dL (7.67 mmol/L). After ROSC, 12-lead ECG demonstrated features consistent with ACS/STEMI (ST-segment elevation in leads II, III, and aVF, with concomitant changes in V1–V4), which was transmitted to the interventional cardiology centre to facilitate urgent qualification for coronary angiography and PCI. Transcutaneous pacing (70/min; capture 85 mA) was used for post-ROSC bradycardia. During the transfer of the patient to the stretcher using a transport sheet, the crew noted deterioration of physiological parameters, including $SpO_2$ and $ETCO_2$. Because the decline in $ETCO_2$ suggested recurrent arrest, pacing was briefly paused to allow reliable evaluation of rhythm and pulse assessment; PEA was identified at approximately 65/min without palpable pulses was identified, prompting continuation of the PEA algorithm.

**THERAPEUTIC INTERVENTION**: Advanced life support was delivered according to the ERC 2025 guidelines. Interventions included defibrillation for shockable rhythms (six shocks in total; Table 1), airway management using a supraglottic airway device (i-gel), controlled ventilation with a transport ventilator (IPPV, VT 500 ml, RR 12/min, oxygen therapy), and mechanical chest compressions using a mechanical chest compression device (LUCAS®, Stryker). Adrenaline was administered in repeated 1 mg IV boluses according to the PEA/asystole algorithm, and unfractionated heparin 5,000 IU IV was administered after recognition of ACS and after hemodynamic consultation. The planned administration of ticagrelor via a gastric tube was withheld due to recurrent cardiac arrest. During transport, $ETCO_2$ was continuously monitored; its decline led to the verification of cardiac rhythm by temporarily suspending transcutaneous pacing, after which management was continued according to the identified non-shockable mechanism (PEA). After arrival at the emergency department, another episode of PEA occurred, followed by VF requiring defibrillation, after which ROSC was achieved and the patient was transferred for invasive treatment.

**FOLLOW-UP AND OUTCOME**: After arrival at the receiving hospital (10:05:37), the patient experienced recurrent cardiac arrest with PEA during transfer out of the ambulance. Mechanical chest compressions were resumed using the LUCAS® device, and adrenaline 1 mg IV was administered. In the emergency department, the interventional cardiologist found no palpable femoral pulse despite ongoing mechanical chest compressions. Because the ETCO2 values remained satisfactory, mechanical CPR and ALS procedures were continued according to ERC 2025 while the patient was being prepared for PCI. At 10:21:00, the rhythm changed to VF, and a sixth defibrillation (360 J) was delivered. ROSC was confirmed at 10:23:04. Without changing the stretcher, the patient was transported directly to the interventional cardiology unit for urgent coronary angiography. Approximately 20 minutes after handover to the interventional cardiology unit, telephone follow-up confirmed successful PCI and patient survival. According to the information provided by the staff over the subsequent 48 hours, the patient remained alive but comatose. No further follow-up data was available to the EMS team at the time of manuscript preparation.

## DISCUSSION

This case illustrates the importance of early dispatcher-assisted bystander CPR and rapid defibrillation in VF, both of which remain fundamental elements of the survival chain in OHCA. Current resuscitation guidelines place high priority on minimising interruptions in chest compressions and quickly identifying shockable rhythms, which in this case was made possible by efficient care organisation [1]. During ALS, capnography ($ETCO_2$) proved to be highly useful for monitoring CPR quality and recognising ROSC (increase to approximately 35 mmHg). At the same time, subsequent decreases in $ETCO_2$ signaled deterioration in perfusion, providing a clinical rationale for immediate reassessment of circulation and rhythm and for continuation of the appropriate algorithm for PEA. Published evidence suggests that $ETCO_2$ is a valuable adjunct in monitoring the effectiveness of resuscitation and may support recognition of ROSC; however, it should always be interpreted in conjunction with the overall clinical assessment [1-5]. Post-ROSC ECG with ACS features enabled early teleconsultation and qualification for invasive treatment.

Suspicion of an acute coronary cause in the context of cardiac arrest is of particular importance because PCI may represent the key causal intervention in selected patients after ROSC. This management strategy is consistent with recommendations for ACS and postcardiac arrest care, which emphasize a rapid diagnostic pathway and timely decisions regarding invasive treatment when clinical presentation and ECG findings suggestive [3]. Organisational aspects also deserve emphasis: the EMS team consisted of three paramedics, allowing parallel execution of key tasks, including chest compressions, rhythm analysis and defibrillation, airway management, preparation and administration, ECG and transport logistics. In settings where only two-person non-physician teams are available, the ability to perform these activities in parallel is substantially reduced. In this case, the three-person crew was able to transport the patient during ongoing resuscitation without requiring additional personnel or resources, reducing the time to hospital arrival while preserving the continuity of essential interventions.

The maintenance of uninterrupted chest compressions was particularly important during extrication and transport. The use of a mechanical chest compression device helped to reduce interruptions and stabilise compression quality in a logistically difficult situation. Although population-level studies have not shown unequivocal superiority of mechanical over manual chest compressions for difficult outcomes across all OHCA populations, systematic reviews and meta-analyses suggest that such devices may be beneficial in specific scenarios, including transport, limited staffing, prolonged resuscitation, and procedures performed during CPR [4,6,7]. Taken together, this case supports the view that a three-person EMS crew may facilitate adherence to guideline-recommended timeframes and reduce interruptions in chest compressions while other critical tasks are performed in parallel. Observational data suggest that larger or more highly trained first-contact EMS crews may be associated with more efficient resuscitation processes and potentially improved patient outcomes [8].

**PATIENT PERSPECTIVE**: The patient was unable to provide a personal perspective due to persistent unconsciousness. Telephone follow-up confirmed survival and successful PCI. According to information obtained from ward staff, the patient remained alive but comatose during the initial 48-hour period.

## CONCLUSIONS

Early CPR for the bystander and prompt defibrillation remain crucial to survival in OHCA. Capnography supported the real-time assessment of resuscitation quality, the identification of ROSC, and the early recognition of perfusion deterioration. Post-ROSC ECG and transmission enabled rapid identification of a likely coronary cause and timely referral for invasive management. In this case, the organisational advantages of a three-person nonphysician EMS crew were particularly evident, as this staffing model enabled effective parallelisation of critical interventions and transport processes. In a two-person crew, such task distribution would have been substantially more challenging and could have increased the risk of interruptions in chest compressions and delays in critical interventions. Definitive treatment of a reversible cause of cardiac arrest may only be possible in hospital, and when such a cause is strongly suspected, transport to a referral centre should be considered even during ongoing resuscitation.

## SUPPLEMENTARY INFORMATION

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***Institutional Review Statement:*** *The study was conducted according to the guidelines of the Declaration of Helsinki.*
***Informed Consent Statement:*** *Informed consent was obtained from all subjects involved in the study.*
***Data Availability Statement:*** *The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.*
***Conflicts of Interest:*** *The authors declare no conflicts of interest.*

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