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Systemic thrombolysis for refractory cardiac arrest due to presumed myocardial infarction

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ABSTRACT

The empiric usage of systemic thrombolysis for refractory out of hospital cardiac arrest (OHCA) is considered for pulmonary embolism (PE), but not for undifferentiated cardiac etiology [1, 2]. We report a case of successful resuscitation after protracted OHCA with suspected non-PE cardiac etiology, with favorable neurological outcome after empiric administration of systemic thrombolysis.

A 47-year-old male presented to the emergency department (ED) after a witnessed OHCA with no bystander cardiopulmonary resuscitation (CPR). His initial rhythm was ventricular fibrillation (VF) which had degenerated into pulseless electrical activity (PEA) by ED arrival. Fifty-seven minutes into his arrest, we gave systemic thrombolysis which obtained return of spontaneous circulation (ROSC). He was transferred to the coronary care unit (CCU) and underwent therapeutic hypothermia. On hospital day (HD) 4 he began following commands and was extubated on HD 5. Subsequent percutaneous coronary intervention (PCI) revealed non-obstructive stenosis in distal LAD. He was discharged home directly from the hospital, with one-month cerebral performance category (CPC) score of one. He was back to work three months post-arrest.

Emergency physicians (EP) should be aware of this topic since we are front-line health care professionals for OHCA. Thrombolytics have the advantage of being widely available in ED and therefore offer an option on a case-by-case basis when intra-arrest PCI and ECPR are not available. This case report adds to the existing literature on systemic thrombolysis as salvage therapy for cardiac arrest from an undifferentiated cardiac etiology. The time is now for this treatment to be reevaluated.

1. Case report

The American Heart Association (AHA) stated fibrinolysis can be considered for cardiac arrest secondary to suspected or confirmed pulmonary embolism (PE), though not for undifferentiated refractory arrest [1,2]. Optimism for thrombolysis for OHCA from suspected acute myocardial infarction (AMI) abruptly halted after 2008 double blinded placebo controlled (DBPC) randomized controlled trial (RCT) reported futility and increased intracranial hemorrhage (ICH) [3-6]. Thereafter, the authors are not aware of further RCT in this topic.

We report a case of successful resuscitation after protracted OHCA with suspected AMI etiology, with favorable neurological outcome after administration of alteplase tissue plasminogen activator (tPA). Our objective is to explore systemic thrombolysis as a salvage therapy for refractory OHCA despite maximal conventional resuscitative efforts.

A 47-year-old male presented to the ED after a witnessed OHCA without bystander CPR. Emergency medical services (EMS) arrived within 10 min and found patient in ventricular fibrillation (VF). He was defibrillated seven times without ROSC; arrived at ED 29 min later in PEA. Advanced cardiac life support continued and he was intubated. He did have three-minute ROSC (37 min into his arrest) where ECG revealed anterolateral AMI.

After 57 min of arrest, 50 mg of intravenous tPA was administered and 11 min later he developed ROSC with sinus tachycardic rhythm, for a total of 68 min downtime. Fifteen minutes later became bradycardic and second 50 mg dose of tPA was administered.

During the remainder of ED stay he developed hypoxia and underwent right tube thoracostomy (suspected CPR-related pneumothorax). Computed tomography (CT) head and CT angiography chest was negative for ICH and PE, respectively. He was weaned off vasopressors in the ED.

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In CCU, he underwent therapeutic hypothermia. He remained comatose until HD four when he began to follow commands in lower extremities. The following morning, he had spontaneous eye opening and was extubated 24 h later. He transferred out of CCU on HD 12, MRI heart on HD 21 suggested myocarditis and cardiac catheterization on HD 22 found non-obstructing disease in the Left Anterior Descending artery.

He was discharged home from the hospital on HD 32 with no residual neurological deficits and cerebral performance category (CPC) score was one. He returned to work within three months post-arrest.

AMI and PE represent 65% of OHCA [7]. The most likely cause of this patient's cardiac arrest was AMI, and Otani described that in witnessed OHCA with initial shockable rhythm, greater than 50% of those are "resistant" to conventional CPR are from AMI [8]. The treatment of choice for AMI is percutaneous coronary intervention (PCI), but infrequently available during cardiac arrest.

Clinicians have reported positive findings utilizing thrombolysis for OHCA in a multitude of research designs. This includes a prospective DBPC RCT [5], before/after prospective study [3], a retrospective propensity-matched analysis [9], a large case series [10] and case reports as recent as 2015 [11-14]. A 2019 meta-analysis reported higher hospital admission rates in patients given thrombolysis, though additional outcomes for efficacy and safety raised concern [15]. The authors are uncertain whether this meta-analysis' higher "survival to admission" in thrombolytic recipients, but similar 24-h survival, could be reflective of early withdrawal of life sustaining treatment (WLST) or higher severity of illness in the thrombolytic recipients. This meta-analysis was also heavily weighted to the neg RCT in 2008, most notably for "survival to discharge" and "bleeding complications" were weighted 66.2% and 78.9%, respectively [6]. This 2008 trial also used Tenecteplace which is difficult to directly compare to prior successful work with Alteplase [3,4].

The probability of achieving a good outcome in cardiac arrest is optimized by a series of interventions starting at the time of arrest [16]. This case illustrates a potential workaround when prehospital care has preserved viability and thrombolytics seem to offer little downside [4].

One intervention which gained popularity is extracorporeal membrane oxygenation (ECMO) with CPR, collectively called ECPR. Data for ECPR for OHCA is only observational trials, and without RCT [17-19]. Our center has ECMO capability but at this time does not offer ECPR. Trials are underway to evaluate its cost-effectiveness and feasibility [20].

Also observed in this case is delayed neurological recovery after cardiac arrest, which contrasts with the fact that WLST remaining a major cause of death of comatose OHCA patients [21]. We recognize that despite our case's CPC-1 survival, no bystander-involved protracted CPR with late administration of systemic thrombolysis, the scale appeared tipped towards futility.

The authors readily acknowledge the substantial limitations of the literature on intra-arrest thrombolytics for OHCA, including publication bias. Since the 2008 RCT, other links in the "chain of survival" have been re-examined and the authors are uncertain if the optimization of other links in the chain, has any effect on utility of intra-arrest fibrinolysis [22,23]. This case report builds on the existing literature on systemic thrombolysis as salvage therapy for cardiac arrest from an undifferentiated cardiac etiology. The time is now for this treatment to be reevaluated.

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All listed authors have contributed to this manuscript process as follows:

*JAH contributed to conceptualization, original draft and review/editing.

*NBB contributed to review/editing and clinically managed the case.

*MSS contributed to review/editing and clinically managed the case.

*DAB contributed to conceptualization, original draft, review/editing, clinically managed the case and supervision.

Declaration of Competing Interest

None.

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