Pharmacotherapy Considerations for the Management of Advanced Cardiac Life Support

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KEYWORDS

• Advanced cardiac life support • Vasopressin • Epinephrine • Cardiac arrest
• Ventricular fibrillation • Ventricular tachycardia

KEY POINTS

- It is critical that all members of the health care team have knowledge concerning the pharmacotherapy for advanced cardiac life support (ACLS).
- At present, vasopressin and epinephrine are the most commonly used agents in cardiac arrest.
- As resuscitation science evolves, potential changes to the treatment of ACLS could occur and providers should remain up to date on these changes.

INTRODUCTION

Sudden cardiac arrest (SCA) is defined as the failure of the heart to contract, and is evident by the loss of pulse.[1] The result is abrupt cessation of effective blood circulation leading to impaired oxygen delivery to vital organs. It is estimated that in 2014, 326,000 out-of-hospital cardiac arrests occurred, with a 10.6% survival rate.[2] An estimated 209,000 persons per year had in-hospital cardiac arrests, with a survival rate of 25.5%.[2] Given the time-sensitive nature of SCA, outcomes are improved when life-supporting measures occur rapidly on recognition.

Resuscitation science is ever evolving. The International Liaison Committee on Resuscitation (ILCOR), consisting of many stakeholders, including the American Heart

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Association (AHA), focuses on fostering new research, evaluating new data, and publishing statements and guidelines regarding post-SCA resuscitation.[3] This organization develops and publishes new emergency cardiac care practice guidelines every 5 years. These recommendations become the basic life support (BLS) and advanced cardiac life support (ACLS) algorithms. The last updates were released in October 2015.[4]

These guidelines detail the critical elements in the management of patients with SCA to optimize chances of achieving return of spontaneous circulation (ROSC), survival to hospital admission, survival to discharge, overall survival, and survival with positive neurologic outcomes.[5] These components include cardiopulmonary resuscitation (CPR), including high-quality chest compressions, defibrillation, pharmacotherapy, therapeutic hypothermia, and postresuscitation management. This article highlights some key evidence regarding the pharmacotherapy for ventricular fibrillation (VF)/pulseless ventricular tachycardia (VT) and pulseless electrical activity (PEA)/asystole. The new adult cardiac support guidelines do not focus on bradyarrhythmias and tachyarrhythmias management strategies and thus are not discussed in this article. It is critical for all members of the health care team who care for patients with SCA to have an intimate knowledge regarding the pharmacologic agents that are used.

TYPES OF CARDIAC ARREST

SCA can be caused by any of 4 cardiac rhythms: VF, pulseless VT, PEA, or asystole. In general, VF is associated with disorganized electrical activity within the ventricular myocardium, whereas VT is more organized.[6] PEA represents a diverse group of organized rhythms that are associated with either lack of or insufficient ventricular activity in providing a perfusing rhythm or detectable pulse. Ventricular asystole refers to the absence of detectable ventricular electrical activity and pulse.[6] In this article, pulseless VT is referred to as VT.

Overall, management of these 4 rhythms is addressed with 2 treatment algorithms: 1 for VF/VT and 1 for PEA/asystole. No matter the type of rhythm involved, BLS (**Fig. 1**) and a coordinated, systematic method of providing ACLS are imperative to optimizing positive outcomes.[6,7] Although these management algorithms exist, it is important to understand that SCA can have many different causes and can occur in almost any type of situation (witnessed, unwitnessed, within the medical setting, or outside of the medical setting). Given this diversity, it is clear that a single approach to management is likely not ideal. However, a cohesive and consistent initial management strategy can help to guide subsequent management of the inciting factor. When these algorithms are implemented in a successful manner, survival rates after witnessed out-of hospital VF arrest approach 50% (range, 5%–50%).[6]

GOALS OF ADVANCED CARDIAC LIFE SUPPORT

The overarching goal of ACLS is for the patient to survive neurologically intact. In order to reach this goal, providers and possibly bystanders need to be rapid responders and proficient in the BLS and ACLS algorithms.[13] By following these guidelines, several short-term goals are highlighted: (1) early CPR and defibrillation; (2) achieving adequate coronary perfusion pressure (CPP), measured via arterial relaxation (diastolic) pressure; (3) achieving adequate cerebral blood flow; (4) ROSC; (5) survival to hospital admission; (6) stabilization of the patient; (7) appropriate post-code management; (8) prevention of future SCA events.[13]