



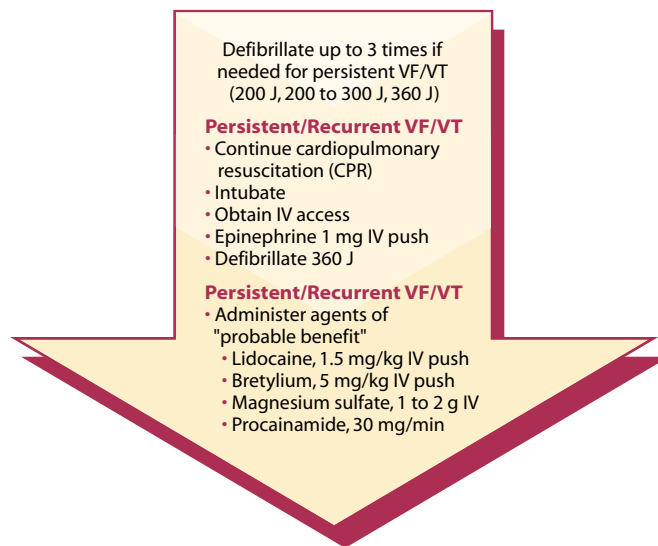
Adding IV Amiodarone to the EMS Algorithm for Cardiac Arrest Due to VF/Pulseless VT

Introduction

- Before the year 2000, the traditional antiarrhythmic agents (lidocaine, bretylium, magnesium sulfate, procainamide, and sodium bicarbonate) were referred to as medications of “probable benefit” for ventricular fibrillation (VF) and pulseless ventricular tachycardia (VT; see **Figure 1**)¹ in the guidelines for Advanced Cardiac Life Support (ACLS) published by the American Heart Association (AHA).

Figure 1

Previous ACLS Guidelines for VF/Pulseless VT



Data from the American Heart Association.¹

- Evidence supporting the use of these traditional antiarrhythmic drugs is limited:
 - Most evidence has been derived from animal studies and retrospective analyses with no control group.

- Studies often found no association between these agents and improved resuscitation outcomes.²
- In contrast, a large body of evidence supporting the use of amiodarone in VF/pulseless VT has resulted from controlled evaluations in patients. Findings from the ARREST trial³—a prospective, randomized, double-blind, placebo-controlled study of intravenous (IV) amiodarone in patients with out-of-hospital cardiac arrest—suggest a role for IV amiodarone in managing patients with shock-refractory VF/pulseless VT and in improving survival rates to hospital admission.
- Equivalent evidence does not exist for other agents.

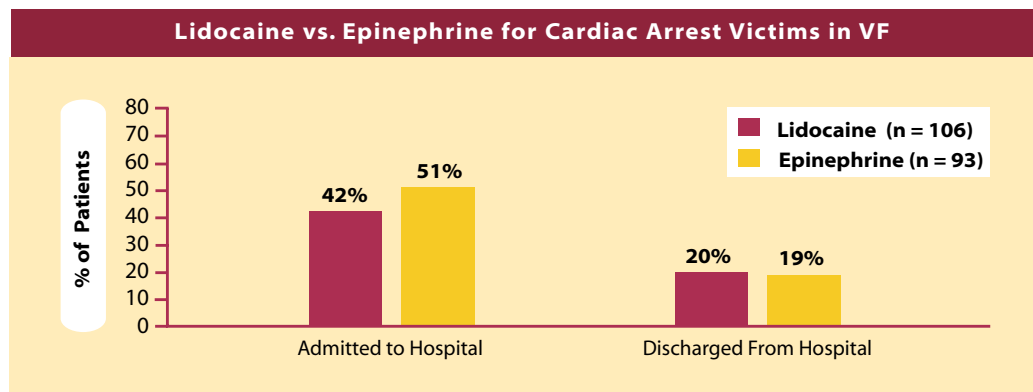
Traditional Antiarrhythmic Agents and Their Limitations

The lack of benefit of these agents in improving patient outcomes is highlighted in the 2000 ACLS Guidelines⁴:

Lidocaine

- Studies do not support the use of this drug as a first-tier choice for treating VT.⁴
- Lidocaine may reduce efficacy of defibrillation and increase the chance of asystole during cardiac arrest.⁵ A randomized trial by Weaver et al⁶ showed no improvement in survival to hospital admission or hospital discharge in cardiac arrest patients given lidocaine versus those given epinephrine (**Figure 2**).

Figure 2

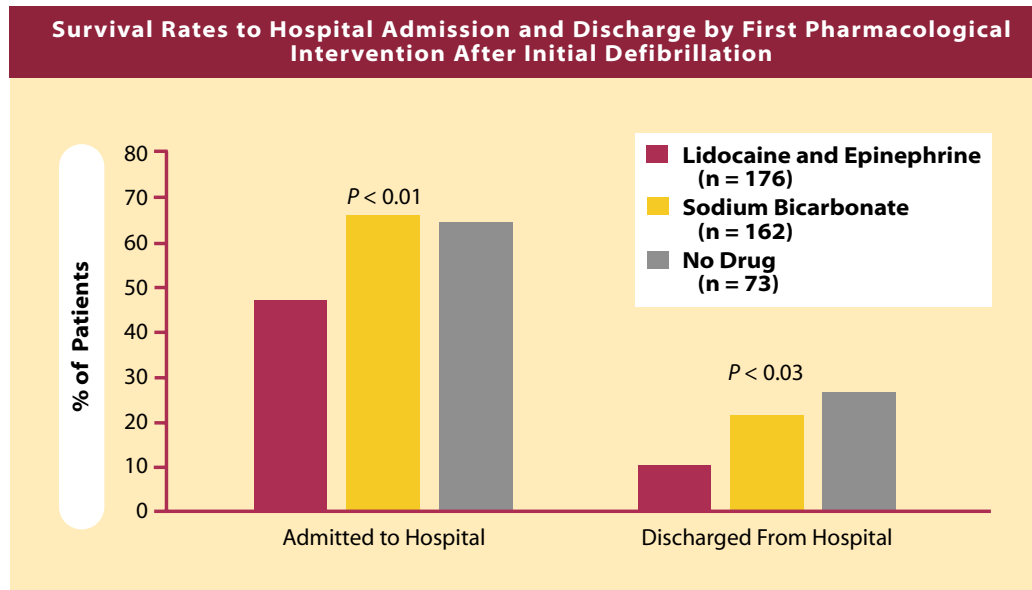


Outcomes from 199 out-of-hospital cardiac arrest patients who persisted in VF after the first defibrillation shock and were randomized to receive either IV lidocaine or IV epinephrine before additional defibrillation attempts. There was no significant difference in outcomes between the two groups.

Reprinted with permission from Weaver WD et al.⁶

- Weaver et al⁶ also found survival rates to hospital admission or discharge were lowest in cardiac arrest patients given lidocaine or epinephrine after first defibrillation as compared with those for patients given sodium bicarbonate or no drug (Figure 3).

Figure 3



Reprinted with permission from Weaver WD et al.⁶

- Lidocaine remains a second choice behind other antiarrhythmic drugs in all four possible VT scenarios addressed in the 2000 ACLS Guidelines.⁴

Bretylium

- Bretylium has been removed from all ACLS treatment algorithms, because of supply issues, side effects, and the availability of other, equally effective and safer agents.⁴

Magnesium Sulfate

- Magnesium is not recommended in cardiac arrest except when arrhythmias are suspected to be caused by magnesium deficiency or when a heart monitor shows torsades de pointes.⁴

Procainamide

- Evidence in favor of procainamide use in cardiac arrest is limited to one 20-patient, retrospective, comparison study.⁴ Delay resulting from slow infusion is a major barrier to the use of procainamide in life-threatening situations.
- Procainamide is not recommended in refractory VF because its prolonged administration time is not appropriate for cardiac arrest.⁴

Sodium Bicarbonate

- Little data exist to indicate buffer therapy improves outcomes. In fact, substantial evidence suggests that bicarbonate may be ineffective or harmful in cardiac arrest situations.⁴

Evidence Supporting Amiodarone

- The evidence supporting the efficacy of amiodarone has been provided by a number of controlled clinical studies (including studies in VF/VT patients by Kowey et al⁷ and Kentsch et al,⁸ as well as the ARREST trial³). Findings from these studies were key factors in the incorporation of IV amiodarone into the 2000 ACLS Guidelines protocol.⁴
 - The ARREST trial³ was a randomized, double-blind, placebo-controlled study to evaluate IV amiodarone for treating out-of-hospital cardiac arrest due to VF/pulseless VT. Survival to hospital admission (the primary end point) was significantly greater in the group receiving IV amiodarone (44% survival to admission) than in the group receiving placebo (34% survival to admission).
 - The recently completed ALIVE^{9,10} trial offers additional evidence. This study was a blinded, randomized trial of IV amiodarone versus IV lidocaine in patients with persistent out-of-hospital VF refractory to three defibrillation shocks, epinephrine, and then a fourth shock. Significantly more patients in the IV amiodarone group survived to hospital admission (the primary end point) as compared with the group receiving IV lidocaine. Survival rates were 22.7% for the IV amiodarone group and 11.0% for the IV lidocaine group.

- Because of the evidence supporting amiodarone, numerous EMS services have added amiodarone to their ambulances and their own treatment protocols. The Austin/Travis County (Texas) EMS system is a typical example:
 - Austin/Travis County EMS serves a rural, suburban, and urban population of approximately 1.2 million residents in an area of about 1,100 square miles, averaging approximately 68,000 calls per year.⁹
 - The Austin/Travis County EMS operations are guided by a Standards of Care manual developed by a specialized committee, along with rigorous classroom programs, training, and examinations.
 - Survival to hospital discharge for patients with out-of-hospital persistent VF improved after the addition of IV amiodarone to the Austin/Travis County treatment protocol.⁹
- In 1998, the Richmond (Virginia) Ambulance Authority became the first emergency response system in the United States to add IV amiodarone to its persistent/recurrent VT/VF protocols as “an immediate first step” before the administration of any other antiarrhythmic drugs.¹¹

Summary

- The evidence provided by the ARREST trial and the recently completed ALIVE trial appears to be sufficient to prove a benefit for amiodarone in survival to hospital admission.
- Survival rates to hospital admission and discharge for cardiac arrest victims have been favorable in the Austin/Travis County EMS area since the addition of IV amiodarone to the resuscitation protocol.⁹
- No other antiarrhythmic agent has supporting evidence to show improved survival to hospital admission in cardiac arrest patients.

- On the strength of the ARREST trial, amiodarone has better evidence-based support for ACLS consideration than any other antiarrhythmic agent.⁴
- Lidocaine, by contrast, has no proven short- or long-term efficacy in cardiac arrest. No study has shown that lidocaine is beneficial in shock-refractory VF.⁴

IV amiodarone is indicated for initiation of treatment and prophylaxis of frequently recurring ventricular fibrillation and hemodynamically unstable ventricular tachycardia in patients refractory to other therapy.

IV amiodarone can also be used to treat patients with VT/VF for whom oral amiodarone is indicated, but who are unable to take oral medication.

IV amiodarone is contraindicated in patients with cardiogenic shock, marked sinus bradycardia, and second- or third-degree AV block in the absence of a functioning pacemaker.

IV amiodarone should be administered only by physicians who are experienced in the treatment of life-threatening arrhythmias, who are thoroughly familiar with the risks and benefits of amiodarone therapy, and who have access to facilities adequate for monitoring the effectiveness and side effects of treatment.

Hypotension is the most common adverse effect seen with IV amiodarone and may be related to the rate of infusion. Hypotension should be treated by slowing the infusion or with standard therapy: vasopressor drugs, positive inotropic agents, and volume expansion.

In clinical trials, the most important treatment-emergent adverse effects were hypotension (16%), bradycardia (4.9%), liver function test abnormalities (3.4%), cardiac arrest (2.9%), VT (2.4%), congestive heart failure (2.1%), cardiogenic shock (1.3%), and AV block (0.5%).

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