EVIDENCE SYNOPSIS

Title: Automated External Defibrillators for Cardiac Arrest During Air Travel

Date completed: March 31, 2015

Authors: Steven Lascher, DVM, PhD, MPH and David R. Goldmann, MD

Clinical question: What are the benefits and harms of automated external defibrillators (AEDs) for cardiac arrest during air travel?

Author recommendations:

For travelers who suffer sudden cardiac arrest (SCA) at the airline terminal or in flight, a combination of cardiopulmonary resuscitation (CPR) and AEDs should be used within 5 minutes or as soon as the SCA is recognized. AEDs automatically and accurately differentiate between ventricular fibrillation/pulseless ventricular tachycardia, which respond to AED shocks, and other arrhythmias accompanying SCA that do not.

Evidence and recommendations:

Quality of Evidence[a]	Strength of Recommendations[b]	Conclusion
Very low	Strong	Evidence favors intervention

[a]Quality of evidence scale (GRADE): high, moderate, low, and very low.
[b]Strength of recommendations scale (GRADE): strong, weak, or no recommendation. For more information on the GRADE rating system, see http://www.gradeworkinggroup.org/index.htm.

PICO:

Population	Adults 18 years of age and older experiencing cardiac arrest during air travel
Intervention	Use of AED
	Frequency and intensity of defibrillation attempts
	Combined with basic CPR and/or pharmacologic therapy
Comparator	CPR and/or pharmacologic therapy only
Primary outcome(s)	Restoration of normal sinus rhythm
	Survival at 7 and 30 days

What are the parameters of our evidence search?

Patients or population: Adults 18 years of age and older experiencing cardiac arrest during air travel
Settings: In flight or airline terminal
Intervention: Use of AED; frequency and intensity of defibrillation attempts; combine with basic CPR and/or pharmacologic therapy
Comparison: CPR and/or pharmacologic therapy only

TABLE 1 Summary of Findings: In-Flight and Airline Terminal AED Use

Study Year	Design (Number of Travelers) Average Age Sex	Setting Intervention (Follow-Up/Study Period)	Risk of Bias	Outcome AED Shocks	Comments
Harve (2009)[1]	Case report (1) 60 years Male 100%	In flight AED use (3 weeks)	High	Normal sinus rhythm at 3 weeks Total shocks in flight and at landing = 24 Glasgow Coma Scale score at admission 11; at hospital discharge 15 (neurologically intact)	None
Caffrey (2002)[2]	Prospective observational (18 with VF) 68 years Male 89%	3 airports AED use (24 months)	High	11/18 fully resuscitated and regained full consciousness 64% of these received one shock, and 36% received two to three shocks All resuscitated were neurologically intact at hospital discharge 91% survival at 1 year	All resuscitated patients were travelers 12 received shocks within 5 minutes, and two of these died. Six received shocks ≥5 minutes, and 4 died 17 of 18 received CPR
Alves (2001)[3]	Case series (3) 46.3 years Male 33%	In-flight AED use	High	One person with SCA died in flight, two at the hospital	1-year experience with AEDs of a Brazilian airline covering three cases of in-flight arrest
O'Rourke (1997)[4]	Retrospective data review (AED usage 109 occasions: 63 for monitoring; 46 for cardiac arrest) 68 years Male (56%) of sudden death group	In flight (27 episodes of cardiac arrest) and at terminals (19 cardiac arrests) AEDs (65 months)	High	VF accounted for 89% of SCAs in terminals, with the majority in aircraft resulting from idioventricular rhythm Of six in-flight VF cases, time to defibrillation was between 27 seconds and 2 minutes 58 seconds; five travelers reverted, and two survived long-term (2 years)	Study covers approximately 31 million international passengers

Continued

TABLE 1 Summary of Findings: In-Flight and Airline Terminal AED Use—cont'd

Study Year	Design (Number of Travelers) Average Age Sex	Setting Intervention (Follow-Up/Study Period)	Risk of Bias	Outcome AED Shocks	Comments
Page (2000)[5]	Prospective observational (200) In flight (191) Terminal (9) 58 years Male 66%	In-flight and terminal AED use 1997-1999	High	AED correctly identified all travelers with VF (14) and those without (sensitivity 100%; specificity 100%) First shock defibrillated the heart in 13 cases Post-conversion survival and full neurological recovery post- discharge: 40% No complications	AED used successfully as a cardiac monitor
Bertrand (2004)[6]	Retrospective data analysis (4194 emergency cases, of which 12 were cardiac arrests) Age range (27-76 years) Male 75%	In-flight AED use 12 months (11/2002-11/2003)	High	25% of cardiac arrest passengers survived. Shockable rhythm (VF) identified in five passengers. No shock in remaining (sensitivity 100%; specificity 100%) Discharge from hospital: 16.6%	Time to application of AED not reported
Brown (2010)[7]	Prospective observational 169 58 years Male 64%	In-flight AED use (05/2004-03/2009)	High	Monitoring 129 (76%) Cardiac arrest 40 (24%) Of these 40, 10 (25%) were due to VT 14 travelers defibrillated, including 9 of 10 with VF; 5 successes with 5 survivors (50%)	Time to AED not reported

AED, Automated external defibrillator; *CPR*, cardiopulmonary resuscitation; *SCA*, sudden cardiac arrest; *VF*, ventricular fibrillation; *VT*, ventricular tachycardia.

Guidelines and performance measures:

American Heart Association: **The 2005 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Part 4. Adult basic life support**;[8] (No AGREE II Score available)—Guideline developer methods

- For adult out-of-hospital cardiac arrest that is not witnessed by an emergency medical services (EMS) provider, rescuers may give a period of CPR (e.g., about 5 cycles or about 2 minutes) before checking the rhythm and attempting defibrillation (Class IIb). In settings with lay rescuer AED programs (AED on-site and available) and for in-hospital environments, or if the EMS rescuer witnesses the collapse, the rescuer should use the defibrillator as soon as it is available. (Class IIa: Benefits are greater than risks. It is reasonable to perform procedure/administer treatment or perform diagnostic test/assessment.)
- AEDs are of no value for arrest not caused by VF/pulseless VT, and they are not effective for treatment of nonshockable rhythms that may develop after termination of VF. Nonperfusing rhythms are present in most patients after shock delivery, and CPR is required until a perfusing rhythm returns. Therefore, the AED rescuer should be trained not only to recognize emergencies and use the AED but also to support ventilation and circulation with CPR as needed. (Evidence and recommendation not rated). From Part 5 of 2005 American Heart Association guideline for Automated External Defibrillators, Defibrillation, Cardioversion, and Pacing.

Author commentary: The evidence supporting the use of AEDs in terminals and during flight is low quality and based on case reports and series, prospective observational studies, and retrospective data analyses. What is evident, however, is accuracy of the monitoring ability of the devices to differentiate between abnormal rhythms not amenable to shock and treatable ventricular fibrillation/pulseless ventricular tachycardia.[5,6] The results across studies are consistent in concluding that even untrained rescuers can effectively use AEDs in emergency situations, and the shorter the time (seconds to <5 minutes) between identification and therapy, the higher the probability of survival up to almost 50%.[7]

Though randomized controlled trials are the gold standard, there are circumstances such as in-flight SCA in which this study design would be unethical and impractical. Consequently, the evidence presented here, albeit low quality, is the best available.

The evidence clearly supports the guideline recommendations, and since 1998, AEDs are required on all passenger-carrying aircraft as part of their emergency medical kits.[9]

Update alerts: Important new citations relevant to this topic are added here as they become available.

Glossary: AGREE II, Appraisal of Guidelines for Research and Evaluation; AED, Automatic external defibrillator; CPR, cardiopulmonary resuscitation; EMS, emergency medical services; GRADE, Grading of Recommendations Assessment, Development and Evaluation; SCA, Sudden cardiac arrest; VF, ventricular fibrillation; VT, ventricular tachycardia.

REFERENCES

1. Harve, H., Hamalainen, O., Kurola, J., et al., 2009. AED use in a passenger during a long-haul flight: repeated defibrillation with a successful outcome. Aviat. Space Environ. Med. 80 (4), 405–408.
2. Caffrey, S.L., Willoughby, P.J., Pepe, P.E., et al., 2002. Public use of automated external defibrillators. N. Engl. J. Med. 347 (16), 1242–1247.
3. Alves, P.M., de Freitas, E.J., Mathias, H.A., et al., 2001. Use of automated external defibrillators in a Brazilian airline. A 1-year experience. Arq. Bras. Cardiol. 76 (4), 310–314.
4. O'Rourke, M.F., Donaldson, E., Geddes, J.S., 1997. An airline cardiac arrest program. Circulation 96 (9), 2849–2853.
5. Page, R.L., Joglar, J.A., Kowal, R.C., et al., 2000. Use of automated external defibrillators by a U.S. airline. N. Engl. J. Med. 343 (17), 1210–1216.

6. Bertrand, C., Rodriguez Redington, P., Lecarpentier, E., et al., 2004. Preliminary report on AED deployment on the entire Air France commercial fleet: a joint venture with Paris XII University Training Programme. Resuscitation 63 (2), 175–181.
7. Brown, A.M., Rittenberger, J.C., Ammon, C.M., et al., 2010. In-flight automated external defibrillator use and consultation patterns. Prehosp. Emerg. Care 14 (2), 235–239.
8. American Heart Association, 2005. The 2005 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Part 4. Adult Basic Life Support 112, 19–34.
9. Federal Aviation Administration, Department of Transportation, 2001. Emergency medical equipment. Final rule. Fed. Regist. 66 (71), 19028–19046.

Recommended citation: Lacher S, Goldmann DR; Elsevier Evidence-Based Medicine Center: Evidence Review: Automated External Defibrillators for Cardiac Arrest During Air Travel. Publication date: March 31, 2015. Access date: April 8, 2015.