Flight diversions for non-shockable cardiac arrest cases. Are they justifiable?

Déroutements de vol pour les cas d'arrêt cardiaque non-choquables. Sont-ils justifiables?

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Claude Thibeault – IATA
Neil Nerwich – International SOS

Disclosure

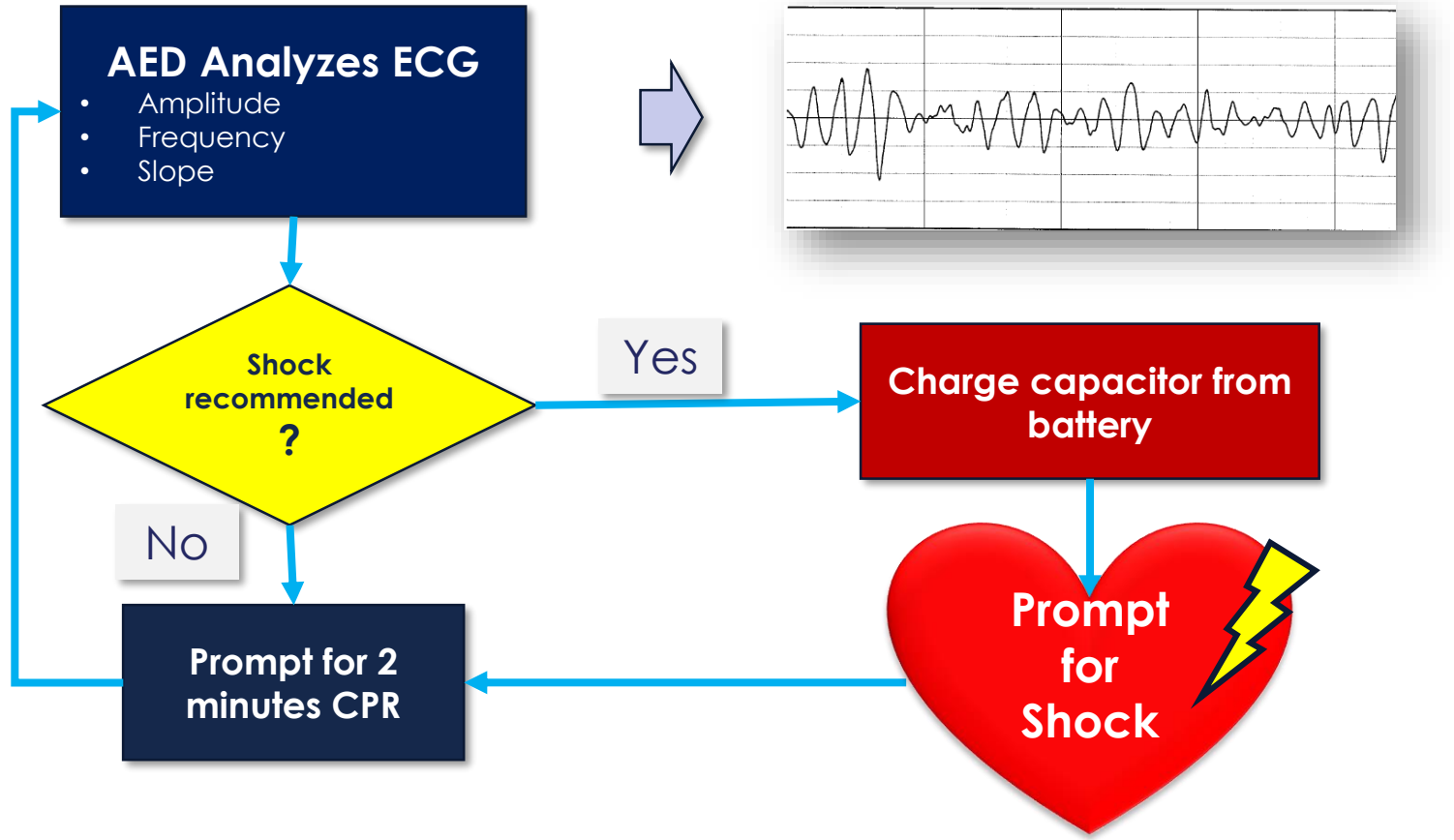
- Paulo Alves is a full-time employee for MedAire
  - A subsidiary of Medaire sells AEDs
- No other conflict of interests to disclose
- Opinions are the authors' only and not necessarily represent the authors' companies
- Same data set as previous study

- Alves PM, DeJohn CA, Ricaurte EM, Mills WD. *Prognostic factors for outcomes of in-flight sudden cardiac arrest on commercial airlines.* Aerosp Med Hum Perform. 2016; 87(10):862–868.

Introduction

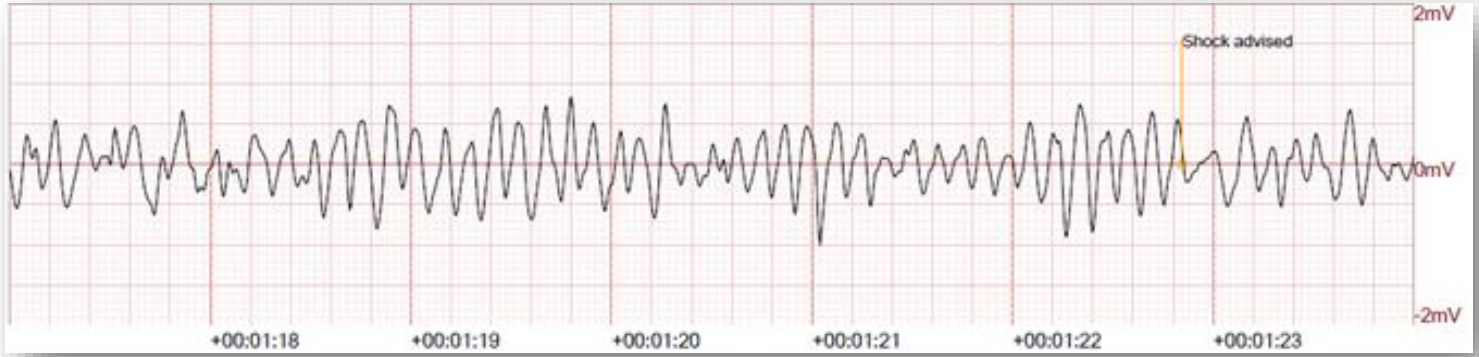
- Medical diversions impose a complex risk/benefit analysis
- Although potentially life-saving, diversions represent cost, operational disruption, and safety concerns
- If anticipated benefit is nil or very small, the risks associated might not be justifiable
- In-flight cardiac arrests could present as Shockable or Non-shockable, as diagnosed by the AED
- The purpose of this study is to review the prognosis of non-shockable cases of IFCA (NSIFCA) and discuss the need to adapt Termination of Resuscitation (TOR) criteria to the in-flight environment.

How AEDs operate…

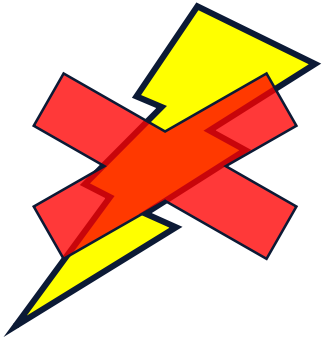


Ventricular fibrillation

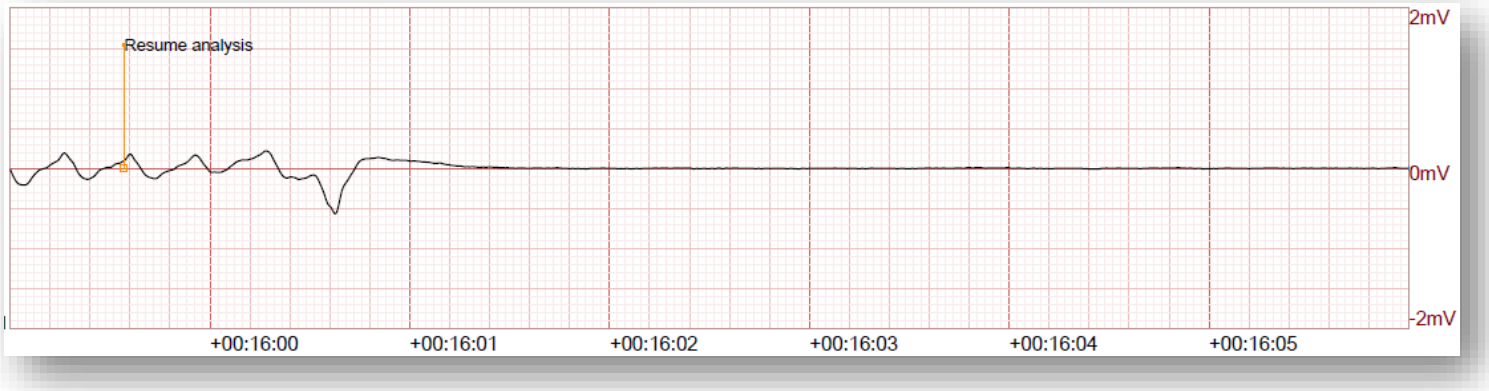
- Underlying mechanism in acute ischemia
- Also present in some cardiomyopathies (i.e. hypertrophic) and primary electrical heart disorders (Long QT syndromes, Brugada, etc...)



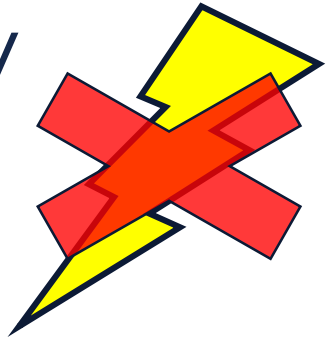
Asystole



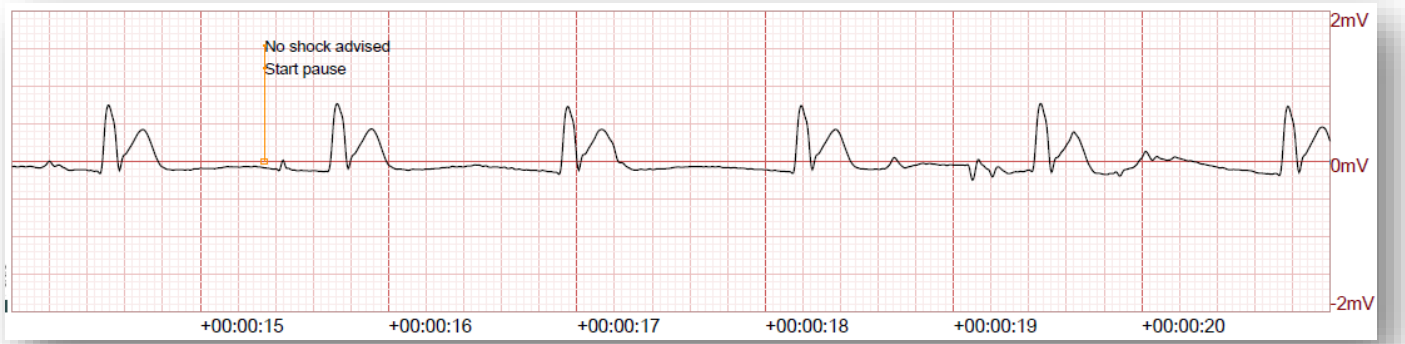
- Usually a terminal event
- Terminal patients
- Hypoxia / asphyxia



Pulseless electrical activity

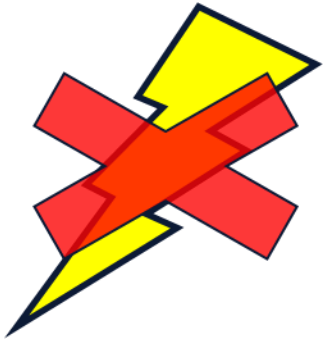


- Internal hemorrhage
- Pulmonary embolism
- Cardiac tamponade

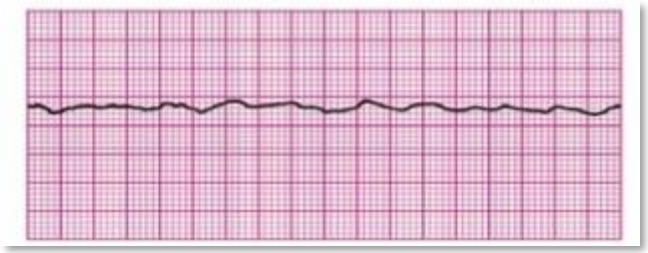


Late (fine) ventricular fibrillation

- Amplitude and frequency below AED detection parameters

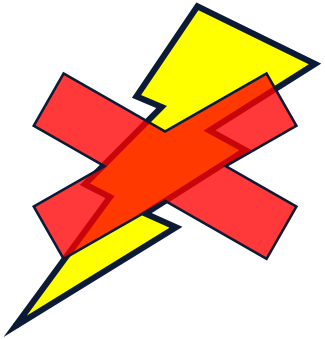


Early

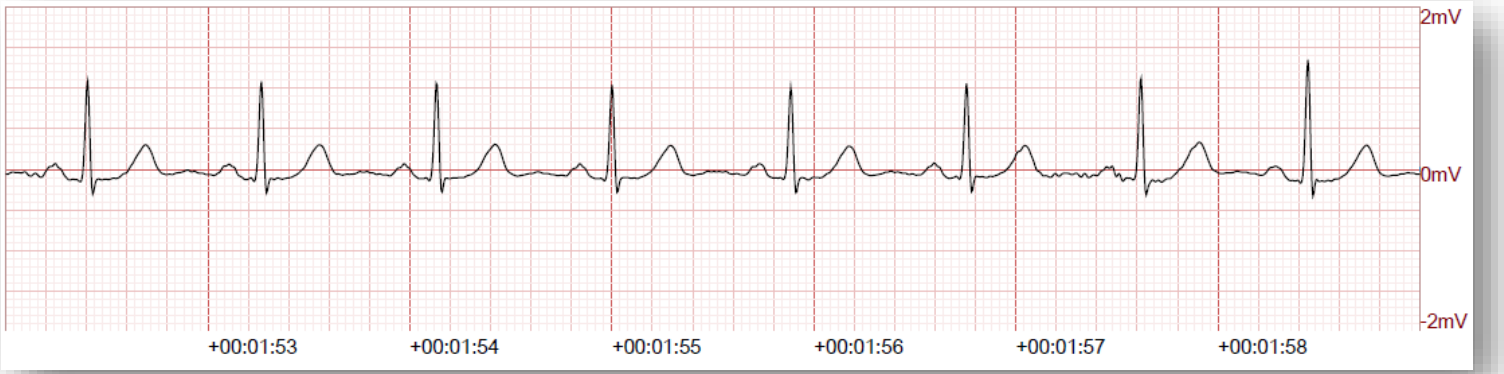


Late

No cardiac arrest



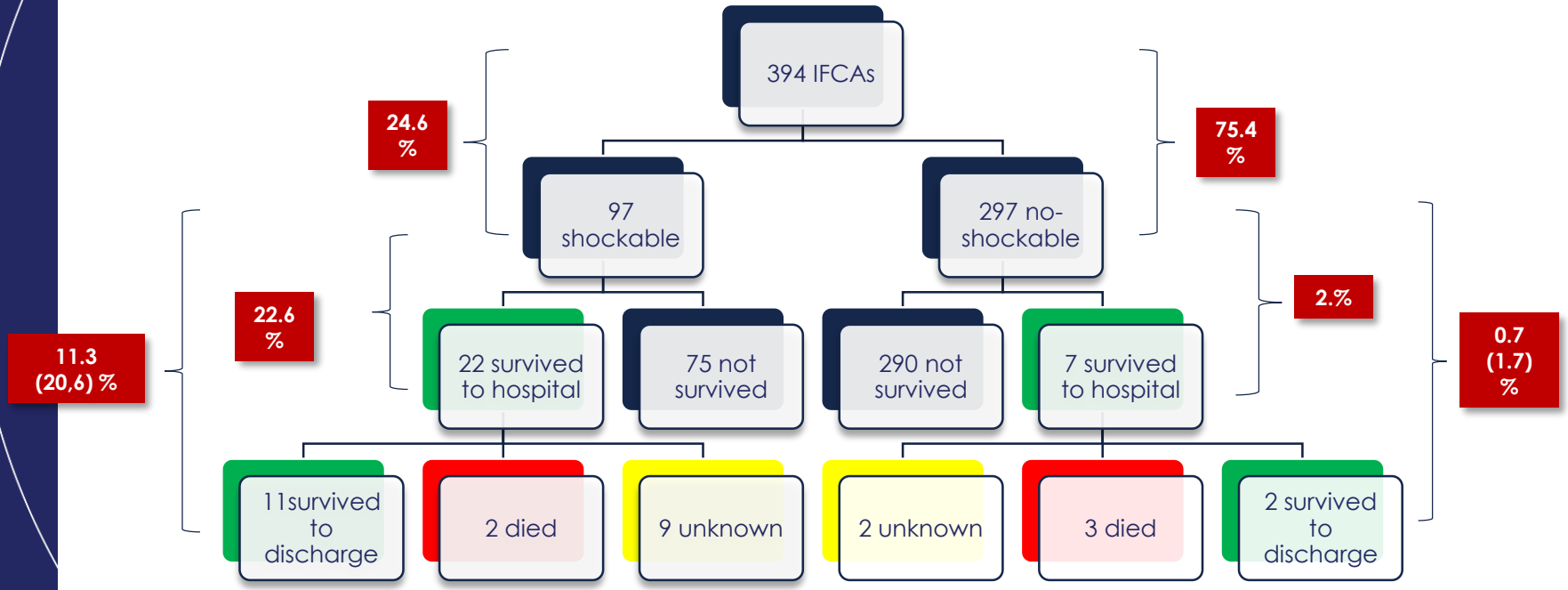
- Vaso-vagal syncope
- Post-ictal state



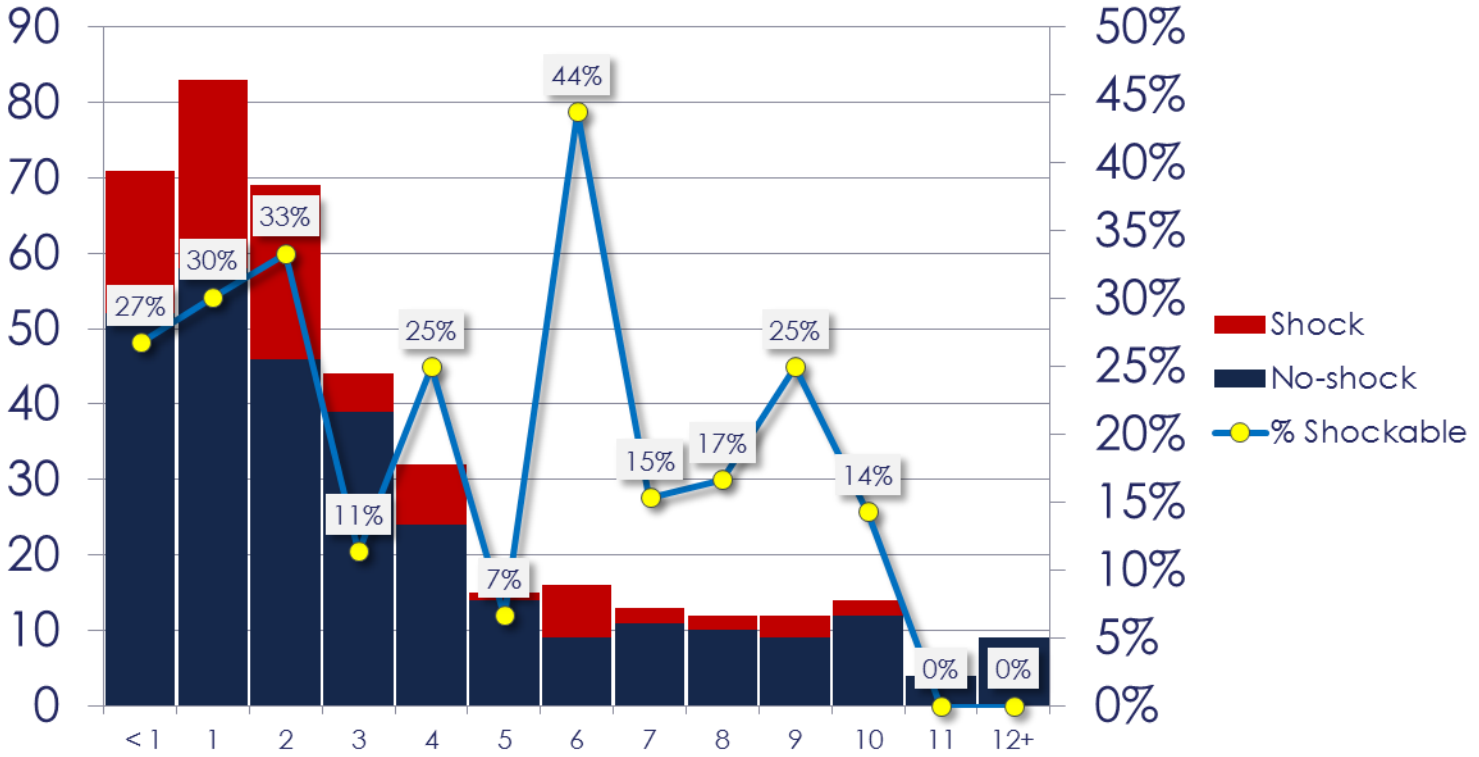
Methods

- 10-year experience with IFCA's handled by MedAire was reviewed
- End goals of survival-to-hospital and survival-to-hospital-discharge were correlated with other variables
- A literature research was performed focusing on review and meta-analysis articles on prognostic data of survival in OHCA and comparing those to published data on IFCA.

Results

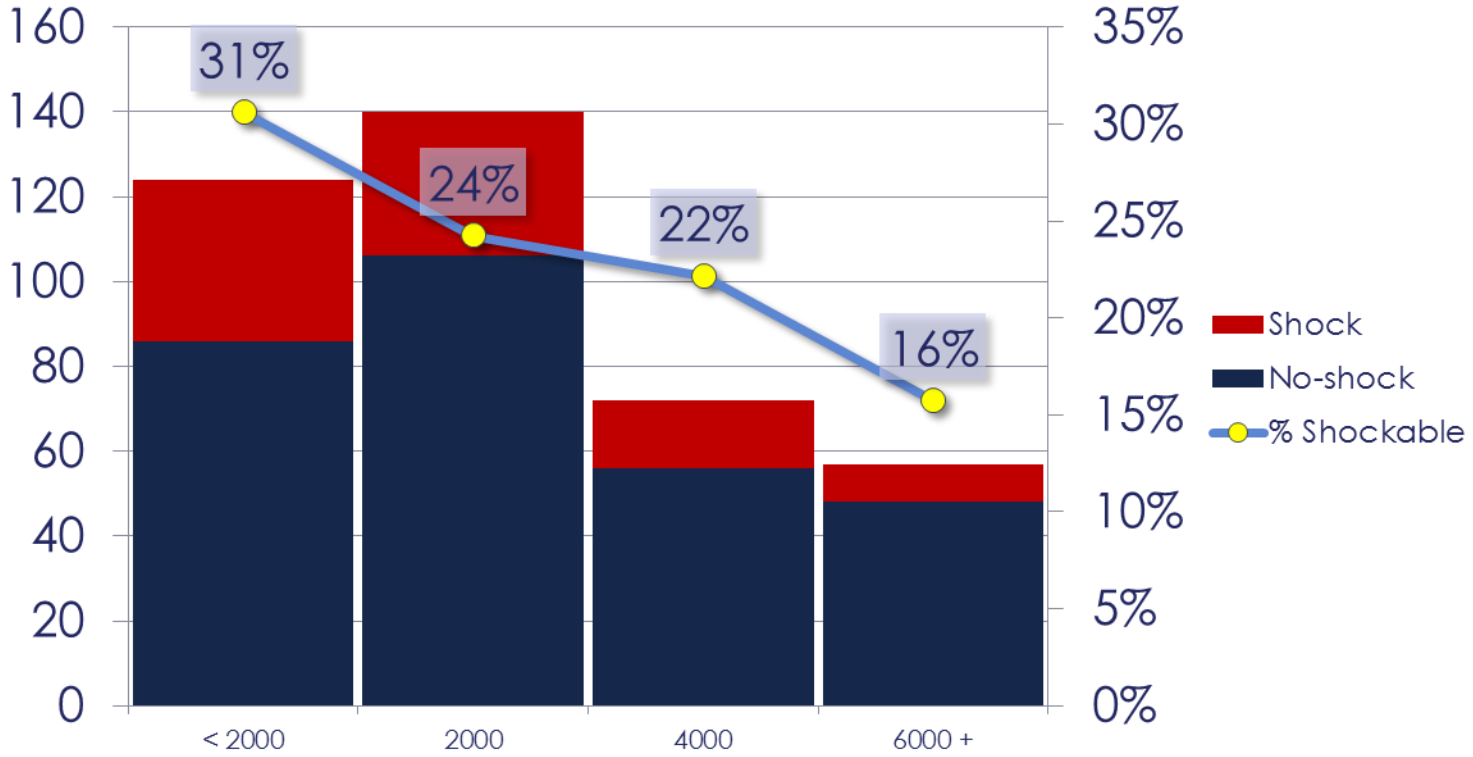

394 IFCAs
24.6 %
75.4 %
97 shockable
297 no-shockable
22.6 %
2.%
11.3 (20,6) %
0.7 (1.7) %
22 survived to hospital
75 not survived
290 not survived
7 survived to hospital
11survived to discharge
2 died
9 unknown
2 unknown
3 died
2 survived to discharge

Hours into flight
Shock versus No-shock

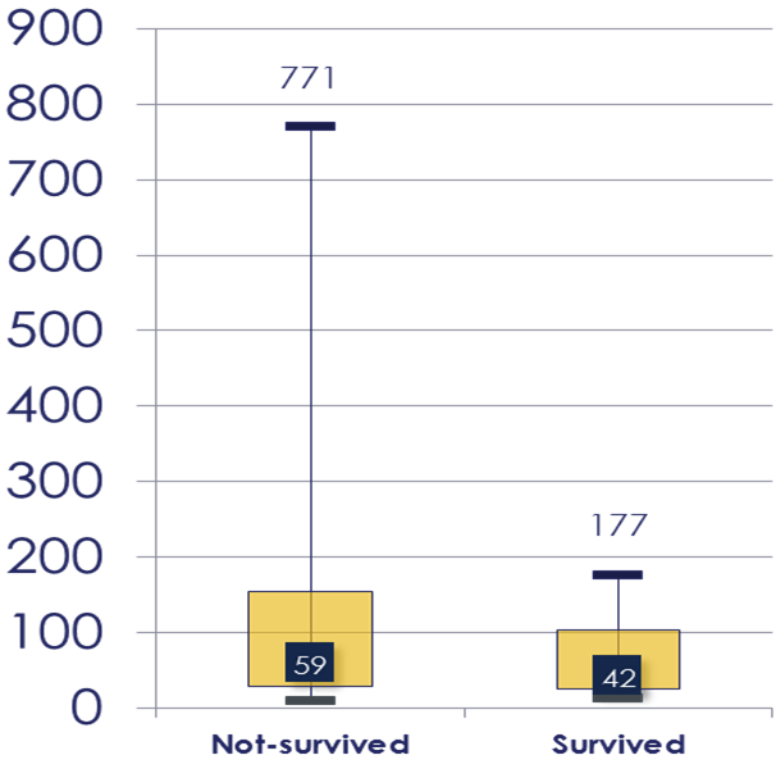


Flight distance (km)

Shock versus No-shock



Minutes to arrival (> 9 min)



p=0.18

Literature review - 1

survival to hospital admission (1.31; 1.16–1.49), hospital survival (2.96; 2.50–3.51) and hospital discharge with good neurologic outcome (4.24; 3.46–5.20).

Conclusion: In CARES, survival was higher among OHCA receiving ETI than those receiving SGA, and for patients who received no advanced airway than those receiving ETI or SGA.

Clinical paper

Airway ma
the CARES registry

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Keywords:
Out of hospital cardiac arrest
Airway management
Endotracheal intubation
Supraglottic airway

ABSTRACT

Background: Optimal out of hospital cardiac arrest (OHCA) airway management strategies remain unclear. We compared OHCA outcomes between patients receiving endotracheal intubation (ETI) versus supraglottic airway (SGA), and between patients receiving [ETI or SGA] and those receiving no advanced airway.

Methods: We studied adult OHCA in the Cardiac Arrest Registry to Enhance Survival (CARES). Primary exposures were ETI, SGA, or no advanced prehospital airway placed. Primary outcomes were sustained ROSC, survival to hospital admission, survival to hospital discharge, and neurologically-intact survival to hospital discharge (cerebral performance category 1–2). Propensity scores characterized the probability of receiving ETI, SGA, or no advanced airway. We adjusted for Utstein confounders. Multivariable random effects regression accounted for clustering by EMS agency. We compared outcomes between (1) ETI vs. SGA, and (2) [no advanced airway] vs. [ETI or SGA].

Results: Of 10,691 OHCA, 5591 received ETI, 3110 SGA, and 1929 had no advanced airway. Unadjusted neurologically-intact survival was: ETI 5.4%, SGA 5.2%, no advanced airway 18.6%. Compared with SGA, ETI achieved higher sustained ROSC (OR 1.35; 95%CI 1.19–1.54), survival to hospital admission (1.36; 1.19–1.55), hospital survival (1.41; 1.14–1.76) and hospital discharge with good neurologic outcome (1.44; 1.10–1.88). Compared with [ETI or SGA], patients receiving no advanced airway attained higher survival to hospital admission (1.31; 1.16–1.49), hospital survival (2.96; 2.50–3.51) and hospital discharge

Review article

Adrenaline for out-of-hospital cardiac arrest resuscitation: A systematic review and meta-analysis of randomized controlled trials☆

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Keywords:
Cardiac arrest

ABSTRACT

Introduction: The evidence for adrenaline in out-of-hospital cardiac arrest (OHCA) resuscitation is inconclusive. We systematically reviewed the efficacy of adrenaline for adult OHCA.

Methods: We searched in MEDLINE, EMBASE, and Cochrane Library from inception to July 2013 for randomized controlled trials (RCTs) evaluating standard dose adrenaline (SDA) to placebo, high dose adrenaline (HDA), or vasopressin (alone or combination) in adult OHCA patients. Meta-analyses were performed using random effects modeling. Subgroup analyses were performed stratified by cardiac rhythm

to admission (RR 0.87, 95%CI 0.76–1.00, p = 0.049; I^2 = 34%) compared to HDA. There were no differences in outcomes between SDA and vasopressin alone or in combination with adrenaline.

Conclusions: There was no benefit of adrenaline in survival to discharge or neurological outcomes. There were improved rates of survival to admission and ROSC with SDA over placebo and HDA over SDA.

Literature review -2

Amiodarone or lidocaine for cardiac arrest: A systematic review and meta-analysis☆

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secondary outcome OR 0.92–1.33, $p = 0.28$) or lidocaine (secondary outcome only OR 0.97–1.45, $p = 0.10$).

Conclusions: Amiodarone and lidocaine equally improve survival at hospital admission as compared with placebo. However, neither amiodarone nor lidocaine improve long-term outcome.

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Keywords:
Out-of-hospital cardiac arrest
Placebo
Hospital admission
Hospital discharge
Return of spontaneous circulation

ABSTRACT

Background: Guidelines for treatment of out-of-hospital cardiac arrest (OOH-CA) with shockable rhythm recommend amiodarone, while lidocaine may be used if amiodarone is not available. Recent underpowered evidence suggests that amiodarone, lidocaine or placebo are equivalent with respect to survival at hospital discharge, but amiodarone and lidocaine showed higher hospital admission rates. We undertook a systematic review and meta-analysis to assess efficacy of amiodarone vs lidocaine vs placebo.

Methods: We included studies published in PubMed and EMBASE databases from inception until May 15th, 2016. The primary outcomes were survival at hospital admission and discharge in OOH-CA patients enrolled in randomized clinical trials (RCT) according to resuscitation with amiodarone vs lidocaine vs placebo. If feasible, secondary analysis was performed including in the analysis also patients with in-hospital CA and data from non-RCT.

Results: A total of seven findings were included in the metanalysis (three RCTs, 4 non-RCTs). Amiodarone was as beneficial as lidocaine for survival at hospital admission (primary analysis odds ratio–OR 0.86–1.23, $p = 0.40$) and discharge (primary analysis OR 0.87–1.30, $p = 0.56$; secondary analysis OR 0.86–1.27, $p = 0.67$). As compared with placebo, survival at hospital admission was higher both for amiodarone (primary analysis OR 1.12–1.54, $p < 0.0001$; secondary analysis OR 1.07–1.45, $p < 0.005$) and lidocaine (secondary analysis only OR 1.14–1.58, $p = 0.0005$). With regards to hospital discharge there were no differences between placebo and amiodarone (primary outcome OR 0.98–1.44, $p = 0.08$; secondary outcome OR 0.92–1.33, $p = 0.28$) or lidocaine (secondary outcome only OR 0.97–1.45, $p = 0.10$).

Conclusions: Amiodarone and lidocaine equally improve survival at hospital admission as compared with

Does transport time of out-of-hospital cardiac arrest patients matter? A systematic review and meta-analysis

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ABSTRACT

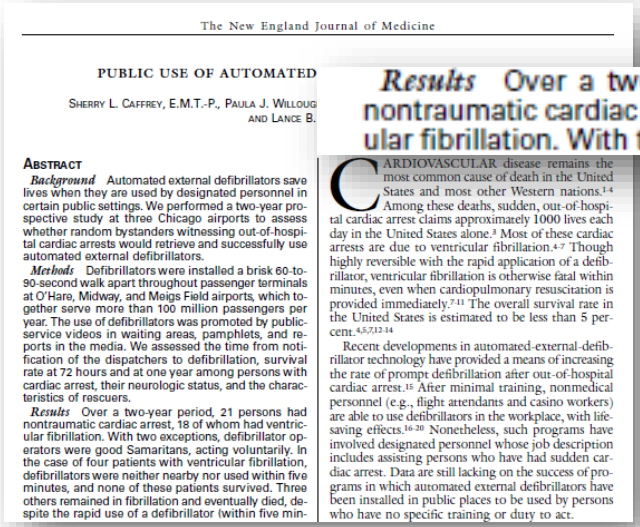
Background: Despite increasing evidence for specialized cardiac arrest centers, the impact of transport time on out-of-hospital cardiac arrest (OHCA) patients' outcome remains unclear. We systematically reviewed the prognostic impact of transport time in OHCA patients.

...ce from inception to ...d outcome in OHCA ... outcomes included ...ere included for final ...CA patients included ...s, and had an initial ... all cardiac rhythms ...patients according to transport time (mean difference −0.05 min [−0.86,0.76]; I^2 25%; 4 studies, 2197 patients).

Conclusion: Paramedic transport time was not associated with survival to hospital discharge or with neurological outcome at hospital discharge in adult OHCA patients. Future studies are needed to prospectively evaluate the prognostic impact of transport time particularly in rural settings and pediatric population.

Conclusion: Paramedic transport time was not associated with survival to hospital discharge or with neurological outcome at hospital discharge in adult OHCA patients. Future studies are needed to prospectively evaluate the prognostic impact of transport time particularly in rural settings and pediatric population.

Literature Review 3



The New England Journal of Medicine

PUBLIC USE OF AUTOMATED

SHERRY L. CAFFREY, E.M.T.-P., PAULA J. WILLOUG
AND LANCE B.

ABSTRACT

Background Automated external defibrillators save lives when they are used by designated personnel in certain public settings. We performed a two-year prospective study at three Chicago airports to assess whether random bystanders witnessing out-of-hospital cardiac arrests would retrieve and successfully use automated external defibrillators.

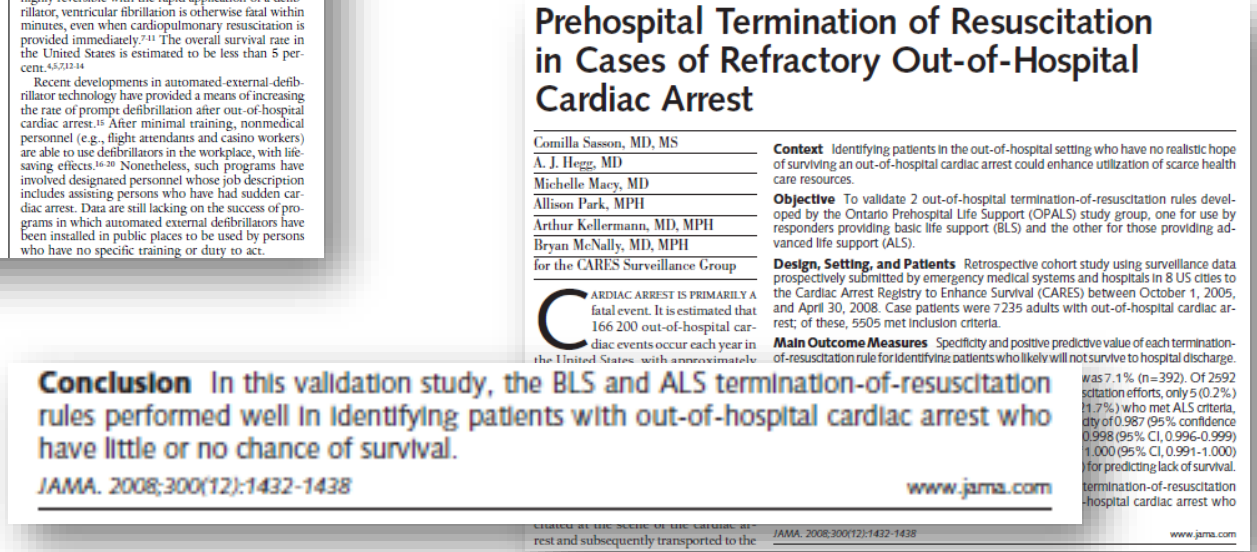
Methods Defibrillators were installed a brisk 60-to-90-second walk apart throughout passenger terminals at O'Hare, Midway, and Meigs Field airports, which together serve more than 100 million passengers per year. The use of defibrillators was promoted by public-service videos in waiting areas, pamphlets, and reports in the media. We assessed the time from notification of the dispatchers to defibrillation, survival rate at 72 hours and at one year among persons with cardiac arrest, their neurologic status, and the characteristics of rescuers.

Results Over a two-year period, 21 persons had nontraumatic cardiac arrest, 18 of whom had ventricular fibrillation. With two exceptions, defibrillator operators were good Samaritans, acting voluntarily. In the case of four patients with ventricular fibrillation, defibrillators were neither nearby nor used within five minutes, and none of these patients survived. Three others remained in fibrillation and eventually died, despite the rapid use of a defibrillator (within five min-

Results Over a two-year period, 21 persons had nontraumatic cardiac arrest, 18 of whom had ventricular fibrillation. With two exceptions, defibrillator op-

CARDIOVASCULAR disease remains the most common cause of death in the United States and most other Western nations.[1-4] Among these deaths, sudden, out-of-hospital cardiac arrest claims approximately 1000 lives each day in the United States alone.[3] Most of these cardiac arrests are due to ventricular fibrillation.[4-7] Though highly reversible with the rapid application of a defibrillator, ventricular fibrillation is otherwise fatal within minutes, even when cardiopulmonary resuscitation is provided immediately.[7-11] The overall survival rate in the United States is estimated to be less than 5 percent.[4,5,7,12-14]

Recent developments in automated-external-defibrillator technology have provided a means of increasing the rate of prompt defibrillation after out-of-hospital cardiac arrest.[15] After minimal training, nonmedical personnel (e.g., flight attendants and casino workers) are able to use defibrillators in the workplace, with life-saving effects.[16-20] Nonetheless, such programs have involved designated personnel whose job description includes assisting persons who have had sudden cardiac arrest. Data are still lacking on the success of programs in which automated external defibrillators have been installed in public places to be used by persons who have no specific training or duty to act.



Prehospital Termination of Resuscitation in Cases of Refractory Out-of-Hospital Cardiac Arrest

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A. J. Hegg, MD
Michelle Macy, MD
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for the CARES Surveillance Group

Context Identifying patients in the out-of-hospital setting who have no realistic hope of surviving an out-of-hospital cardiac arrest could enhance utilization of scarce health care resources.

Objective To validate 2 out-of-hospital termination-of-resuscitation rules developed by the Ontario Prehospital Life Support (OPALS) study group, one for use by responders providing basic life support (BLS) and the other for those providing advanced life support (ALS).

Design, Setting, and Patients Retrospective cohort study using surveillance data prospectively submitted by emergency medical systems and hospitals in 8 US cities to the Cardiac Arrest Registry to Enhance Survival (CARES) between October 1, 2005, and April 30, 2008. Case patients were 7235 adults with out-of-hospital cardiac arrest; of these, 5505 met inclusion criteria.

Main Outcome Measures Specificity and positive predictive value of each termination-of-resuscitation rule for identifying patients who likely will not survive to hospital discharge.

CARDIAC ARREST IS PRIMARILY A fatal event. It is estimated that 166 200 out-of-hospital cardiac events occur each year in the United States, with approximately

rest and subsequently transported to the

was 7.1% (n=392). Of 2592 scitation efforts, only 5 (0.2%) 1.7%) who met ALS criteria, dity of 0.987 (95% confidence 0.998 (95% CI, 0.996-0.999) 1.000 (95% CI, 0.991-1.000) for predicting lack of survival. termination-of-resuscitation -hospital cardiac arrest who

Conclusion In this validation study, the BLS and ALS termination-of-resuscitation rules performed well in identifying patients with out-of-hospital cardiac arrest who have little or no chance of survival.

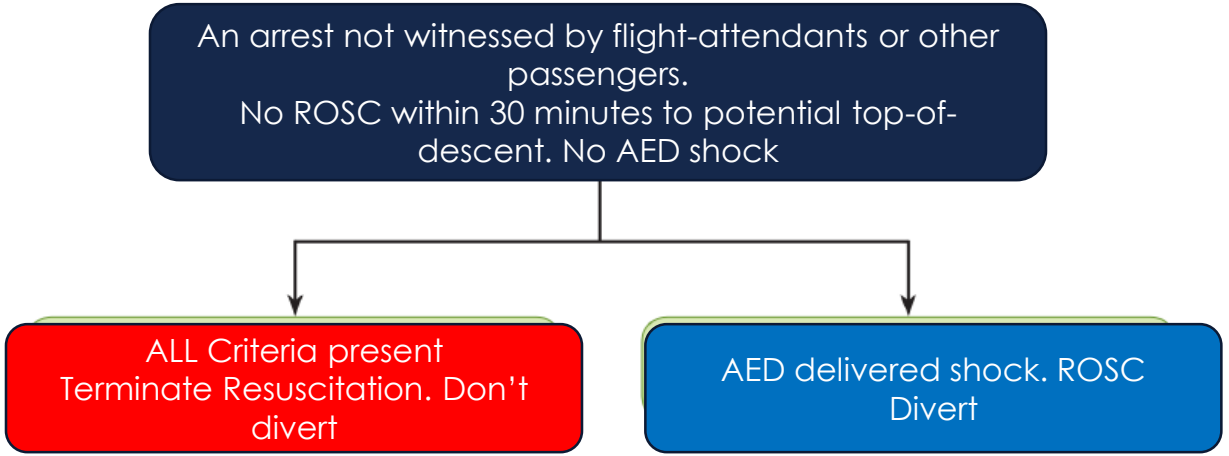
JAMA. 2008;300(12):1432-1438 www.jama.com

Safety aspects

- Not (usually) possible to land from cruising altitude in less than 20 minutes
- CPR during landing
  - Safety of the rescuer
  - Split attention – other passengers
  - Compromised evacuation route

Criteria for termination of resuscitation on site for OHCA

In-flight Termination of Resuscitation / not-diverting



BLS termination-of-resuscitation rule for adult OHCA.

Conclusions 1

- IFCAs are a subset of out-of-hospital cardiac arrest (OHCA)
- Prognosis for non-shockable rhythms is very poor
- Advanced life support has no clear benefit in OHCA
- The best chance for non-shockable rhythms is good quality CPR or no cardiac arrest
- Diverting for non-shockable rhythms might be futile and risks probably outweigh any benefit
- Criteria for not-diverting could be implemented adapting from existing guidelines for OHCA – TOR

Conclusions 2

- An unorthodox cost/benefit justification for having AEDs could be diversion avoidance for non-shockable IFCAs
- Moral, ethical and legal implications should be better discussed