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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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
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...

AED Analyzes ECG
- Amplitude
- Frequency
- Slope

Shock recommended?

Yes
- Charge capacitor from battery

No
- Prompt for 2 minutes CPR

Prompt for Shock
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

97 shockable
- 22 survived to hospital
- 75 not survived

297 no-shockable
- 290 not survived
- 7 survived to hospital

- 11 survived to discharge
- 2 died
- 9 unknown
- 2 unknown
- 3 died

24.6%

75.4%

11.3% (20.6)%

22.6%
Hours into flight
Shock versus No-shock

- Shock
- No-shock
- % Shockable
Flight distance (km)
Shock versus No-shock

- < 2000 km: 31% Shock, 69% No-shock
- 2000 km: 24% Shock, 76% No-shock
- 4000 km: 22% Shock, 78% No-shock
- 6000+ km: 16% Shock, 84% No-shock

% Shockable: 35%
Minutes to arrival (> 9 min)

- Not-survived: 59
- Survived: 42

$p=0.18$
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.

Review article

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


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 Survivability (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 16,501 OHCA, 5991 received ETI, 3110 SGA, and 1920 had no advanced airway. Unadjusted neurologically-intact survival was: ETI 54.1, SGA 52.8, no advanced airway 16.8%. Compared with SGA, ETI achieved higher sustained ROSC (OR 1.35; 95%CI 1.19–1.54), survival to hospital admission (1.36; 1.19–1.53), 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 with good neurologic outcome (4.24; 3.46–5.20).

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 SGA 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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Abstract

Background: Guidelines for treatment of out-of-hospital cardiac arrest (OHCA) 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 12th, 2016. The primary outcome was survival at hospital admission and discharge in OHCA 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 arrest and data from non-RCT. Results: A total of seven findings were included in the metaanalysis (three RCT, four non-RCT). Amiodarone was as beneficial as lidocaine for survival at hospital admission (primary analysis odds ratio = 0.88, 95% CI = 0.7-1.39, p = 0.06; 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 1.23-1.54, p = 0.001; secondary analysis OR 1.07-1.45, p = 0.003) and lidocaine (secondary analysis only OR 1.04-1.89, p = 0.00006). 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 0.85-1.35, p = 0.28) or lidocaine (secondary outcome only OR 0.93-1.45, p = 0.10). Conclusion: Amiodarone and lidocaine equally improve survival at hospital admission as compared with placebo.

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.

Methods: We included studies published in PubMed and EMBASE databases from inception to May 12th, 2016. The primary outcome was survival to hospital discharge and/or neurological outcome at hospital discharge in adult OHCA patients. Future studies are needed to prospectively evaluate the 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.
Results Over a two-year period, 21 persons had nontraumatic cardiac arrest, 18 of whom had ventricular fibrillation. With two exceptions, defibrillator op-
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

- An arrest not witnessed by flight-attendants or other passengers.
  - No ROSC within 30 minutes to potential top-of-descent. No AED shock

  - ALL Criteria present
    - Terminate Resuscitation. Don’t divert
  - AED delivered shock. ROSC
    - Divert

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.