Double Sequential External Defibrillation (DSED)

That's not currently in my ALS algorithm

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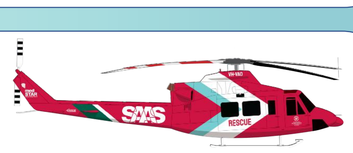
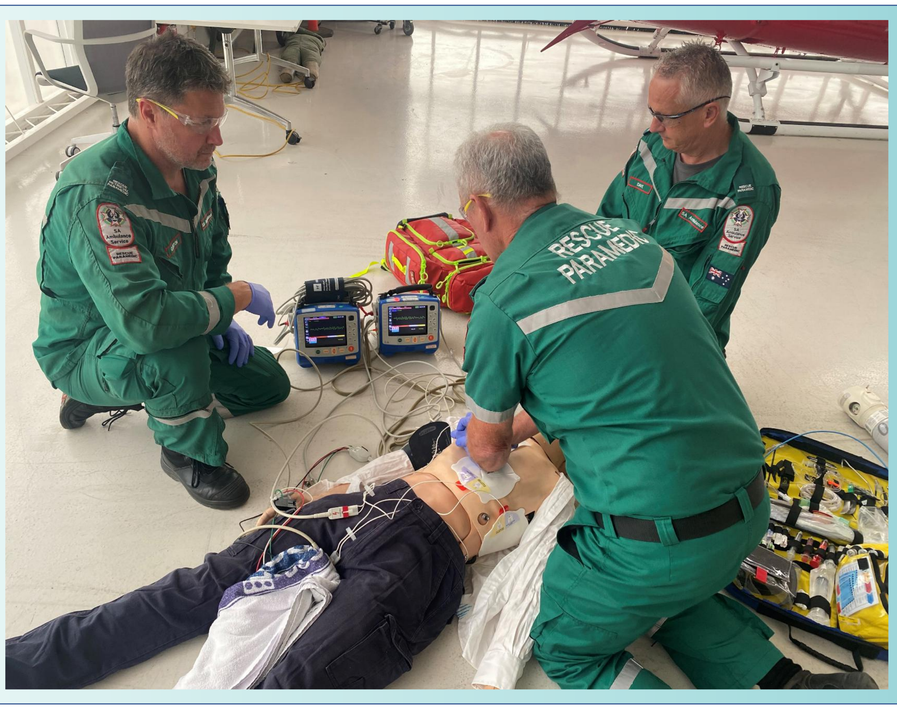
Introduction

- Advances in defibrillator technology, public access to automated external defibrillators, improvements in pre-hospital advanced life support training and cardiopulmonary resuscitation (CPR) all attribute to improving outcomes in cardiac arrest.
- However a small cohort will be resistant to resuscitation and will develop refractory ventricular fibrillation (rVF) with a mortality rate of up to 97%[1].
- ***So what can we do for this cohort to improve survival?***
- Vector Change (VC) therapy is the use of an opposing vector to the previous electrical current(s).
- DSED is the use of two separate defibrillator devices that are both discharged simultaneously, or in sequence, to potentially terminate the rVF and achieve return of spontaneous circulation (ROSC).

Pre-hospital Case Study



- 27-year-old male (estimated weight ***275*** kg) in conscious symptomatic VT – prolonged extrication form residence
- DC synchronized cardioversion 150 Joules ➡ VF
- rVF (DC shock 200J x 4) Amiodarone 300mg (after 3rd shock) / Magnesium 2gm stat IV
- VC DC shock 200J x 1 / DSED 400J (200J on each device) x 1 - ROSC
- Discharged from hospital neurologically fully intact



Discussion

- Definitions globally of rVF differ, most commonly is VF after 3 DC shocks.
- However, the literature demonstrates that it can range from one DC shock and up to three to five DC shocks plus or minus the inclusion of an antiarrhythmic.
- The European Resuscitation Council, the Resuscitation Council UK and the American Heart Association state that DSED is currently ***NOT*** recommended due to the lack of evidence pre-2021.
- The Australian Resuscitation Council does not mention the use of DSED, but recommends increasing the joules to the maximum capability the device.
- However, if you were faced with a patient being actively resuscitated and is in rVF this is as an algorithm that could be considered:

High performance CPR in progress & rVF confirmed

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Place second set of defibrillator pads in the opposite vector position and re- attempt single device defibrillation in that vector

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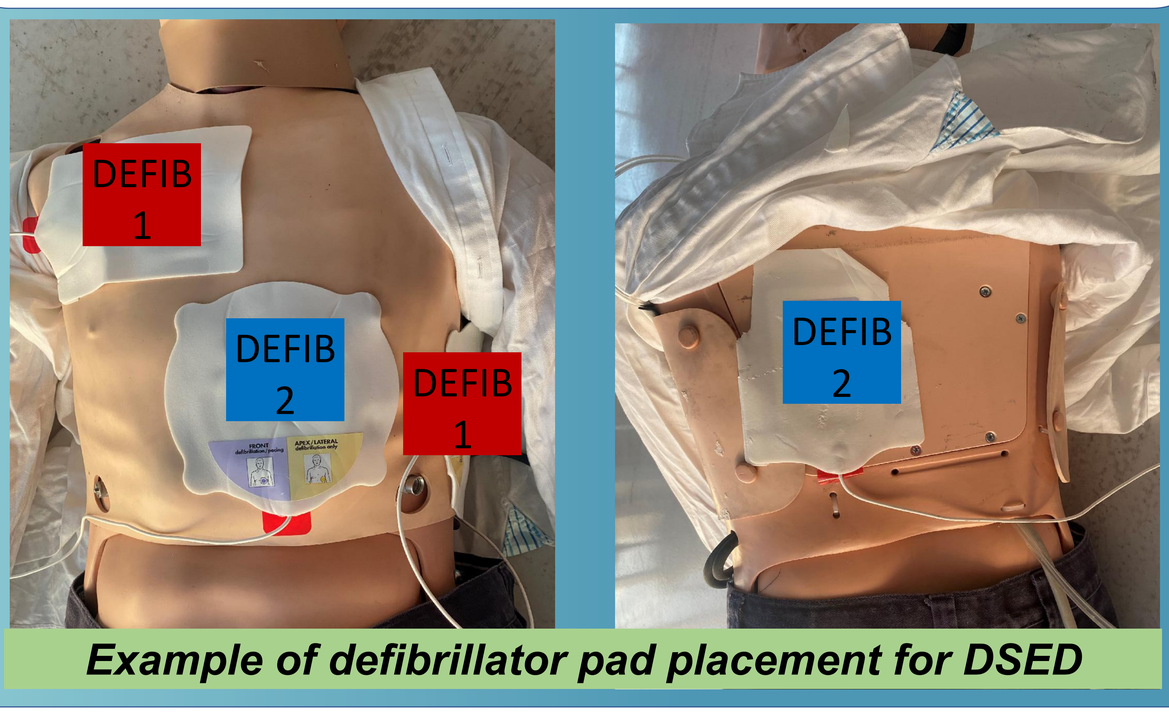
Perform DSED using a single operator for both defibrillator devices



Example of defibrillator pad placement for DSED

Evidence

- Several theories have been postulated around the termination of rVF such as the amount of energy or power used, the lowering of transthoracic impedance & the multi vector theory.
- The DOSEVF trial [2] showed an improved termination of VF, ROSC and survival to discharge of both VC and DSED over standard resuscitation techniques pre-hospital and no damage to defibrillator systems was recorded despite the number of cases.
- Other research has shown no statistical difference between DSED and standard defibrillation techniques[3].
- Further research is needed on DSED therapy in the pre-hospital space to explore whether simultaneous versus sequential delivery is more beneficial to overall survival.

Conclusions

- VC & DSED is safe, feasible and effective however is currently not in standard guidelines and there is a theoretical risk of possible defibrillator damage, however there is no current evidence to support this theory.
- A standard definition of rVF globally needs to be defined.
- VC and DSED like extracorporeal CPR (ECPR) can form a part of the pre-hospital retrieval and transport clinicians "Tool Box" for consideration during resuscitation.

References

1. Ramzy, M. Hughes, P. (2022) *"Double Defibrillation"* StatPearls Publishing LLC.
2. Cheskes, S. (et.al.) (2020) *"Double sequential external defibrillation for refractory ventricular fibrillation: The DOSE VF pilot randomized controlled trial"*. Resuscitation. 150, 178 – 184
3. Yongkai, Li. (et.al.) (2022) *"Double sequential external defibrillation versus standard defibrillation in refractory ventricular defibrillation: A systematic review and meta-analysis"* Frontiers in Cardiovascular Medicine. 9:1017935.4
4. Cheskes, S. (et.al.) (2022) *"Defibrillation Strategies for Refractory Ventricular Fibrillation"* The New England Journal of Medicine. 387:1947-1956