Mechanical Cardiovascular Support (MCSD's) During Road & Aeromedical Transport

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Introduction

Transport of MCRSD's via road, rotary or fixed wing aircraft requires considerable clinical knowledge, logistics and teamwork.

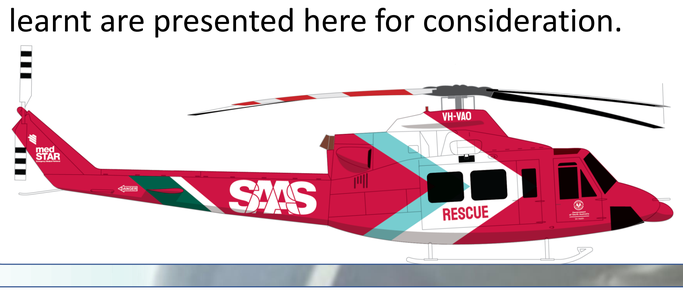
SAAS MedSTAR has the capability to transport adult, paediatric and neonatal patients utilising road, rotary and fixed wing transport platforms within South Australia and interstate.

From 2018 to 2023 SAAS MedSTAR has transported by road and fixed wing 52 IABP patients, 16 ECMO patients and 12 VAD patients.

From this clinical experience we have been able to develop robust transport guidelines detailing all aspects of the transport, form initial tasking request to patient arrival at the destination.

The use of pre departure checklists and clinical aide memoirs are imperative to safely transport patients undergoing MCRSD's.

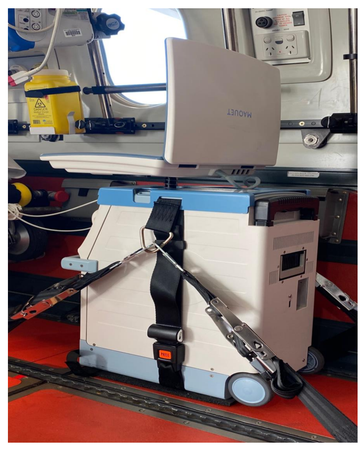
Some of the key transport principles and lessons learnt are presented here for consideration.



Intra Aortic Balloon Pump (IABP)

Aeromedical / Transport considerations

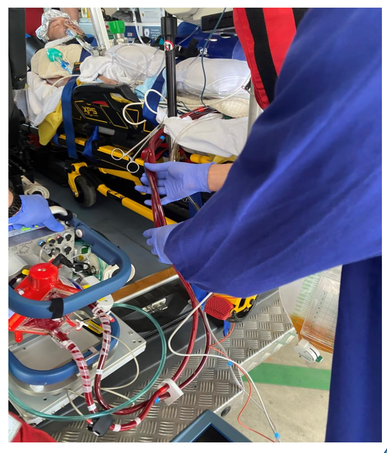
- Percutaneous catheter + driveline security & management
- Li-ion battery capacity
  - Hot swappable capability
  - Securing of spare batteries safely for flight
- AC power requirements
- Helium cylinder v reservoir capacity and altitude considerations
  - Boyles law effects on device operation
  - Altitude effects on helium availability
  - Critical to know your helium calculations
- Securing infight / in transit
- '**Actions On'** plan during emergencies
- Avoid prolonged periods of balloon stasis



Extra Corporeal Membrane Oxygenation (ECMO)

Aeromedical / Transport considerations

- Percutaneous cannulas security & management
- Li-ion battery capacity
- AC power requirements
- VA or VV – Know your therapy
- Adequate oxygen supply for ECMO oxygenator and mechanical ventilation
- Need for POCT ABG / COAG in flight
- Used in conjunction with IABP more commonly
  - Double the considerations!
- Securing infight / in transit
- Ability undertake temporary manual support of pump at all times in case of failure

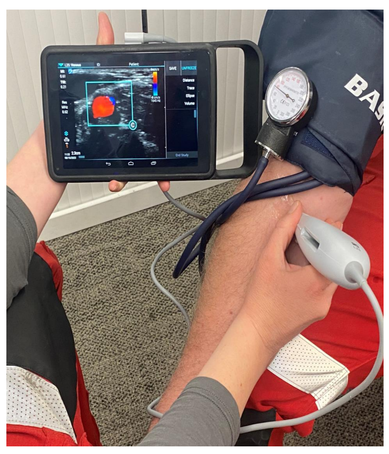


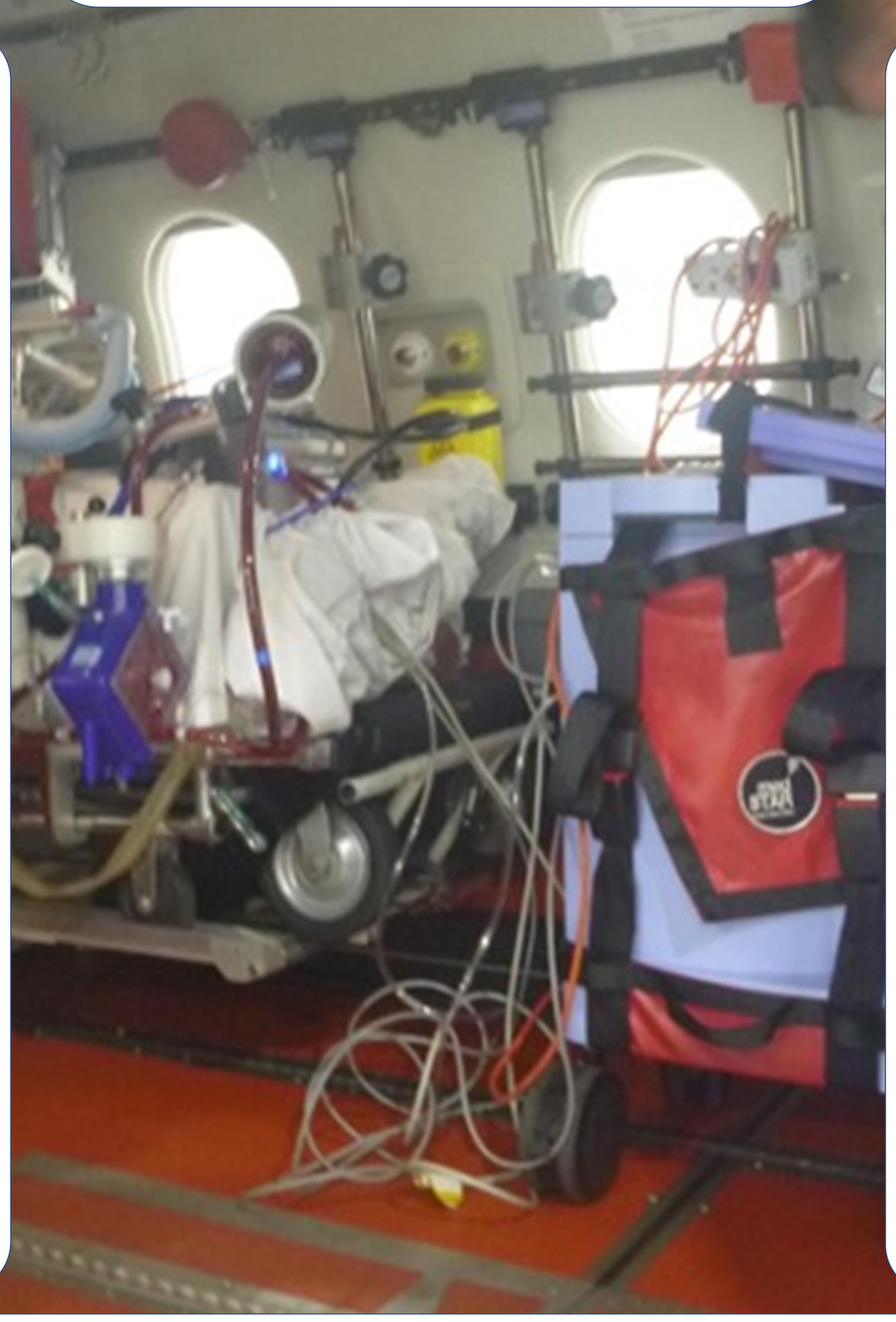
Ventricular Assist Devices (VAD's)

Implanted or paracorporeal

Aeromedical / Transport considerations

- Patients can be located rural community not just in metropolitan areas – be prepared!
- Percutaneous driveline security & management
- Li-ion battery capacity
  - Hot swappable capability
  - Securing of spare pump & batteries safely
- AC power supply (paracorporeal)
- Patients are mostly 'pulseless' = No BP
- NiBP & pulse oximetry can be unreliable
- Doppler or POCUS to assess MAP
- Know emergency management procedures
  - ✓ '**Actions On'** emergency response pocket card





Aviation Risks / Mitigation of MCSD's

- Electromagnetic Interference testing (EMI)
- Device securement testing &approval by aeronautical engineers
- Ensure AC power requirements do not exceed platform capability
- G-force considerations
- In hanger / loading of these patients
  - Weather / at night – good lighting
- Utilise aircraft APU on loading to conserve medical battery
- DG storage of extra helium cylinders
- Hard cases for spare Li-ion batteries
- Li-ion battery risk
  - LIPO pouches
  - Know your emergency procedures

Conclusions

- Education, training and simulation on transport of MCSD's to all clinical personnel and key transport stakeholders is paramount.
- Meticulous planning and organisational preparedness is required including knowledge of anticipating and recognising potential complications to mitigate adverse events.
- The use of pre-departure 'checklists' and 'actions on' aide memoirs are essential tools for success.

References

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- Thomas, F. Mills, G. Howe, R Zobell, J (2012) "Lithium Battery Fires: Implications for Air Medical Transport" *Air Medical Journal* 31:5, pp. 242 – 248.