Clinical Guidance

Paediatric Critical Care: Aeromedical Transfer

Summary

Guidance for aeromedical retrieval of critically ill children.

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Relevant external law, regulation, standards	
This guideline represents the views of STRS and was produced after careful consideration of available evidence in conjunction with clinical expertise and experience. The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient. This clinical guideline has been produced by the South Thames Retrieval Service (STRS) at Evelina London for nurses, doctors and ambulance staff to refer to in the emergency care of critically ill children.	

Change History		
Date	Change details, since approval	Approved by
Sept 2021	Minor Formatting Contact Numbers Updated	ELCGC Sept 2021

Paediatric Critical Care: Aeromedical Transfer

INDICATIONS

- Overseas retrieval or repatriation (air ambulance, commercial)
- Life-threatening illness requiring urgent specialised intervention
  - Head injury
  - Emergency surgery
  - ECMO
- Long distance (>60 minutes travelling time by road) to be travelled with unstable patient - consider helicopter
- Very long distance (>120 minutes travelling time by road) to be travelled with patient requiring PICU admission – consider fixed wing or helicopter

CHOICE OF AIRCRAFT

Helicopter: Shorter distance. Drop off and pick up closer to destination. Cramped interior. Noise, vibration and climate control problematic. LOW altitude un-pressurised cabin <1000m (~3000ft). High altitude problems of fixed wing transfers NOT applicable

Fixed wing: Longer distances. More space. Better light & climate control

Air ambulance: Smaller, refuelling stops required, power & gas source may be available. Check compatibility. Some medical equipment on board

Commercial flight: Self-sufficient for all equipment power. Cruising cabin altitude is 8-10 000ft (= 3000m).

MEDICAL CONSIDERATIONS

(Helicopter transfer unaffected by altitude)

Airway:

- ETT position must be radiologically confirmed
- ETT adequately secured. ETCO2 monitoring in place
- Uncuffed ETT is preferable or ETT cuff filled with 0.9% sodium chloride (ensure a small leak)
- Airway suctioned prior to moving. Take portable suction equipment. Take manual suction (foot/ hand pump) for long journey.

Breathing:

- Exclude pneumothorax. Any air leak, however small, must be drained for flight. Heimlich valves to all chest drains. Add drainage bag if effusion
- ETCO2 monitoring essential (as auscultation not possible in helicopter)
- Portable oxygen to cover journey time (x2) independent of aircraft (see oxygen calculation. Check compatibility of O2 connections
- Once airborne, anticipate fall in saturations & increased FiO2 and ventilator requirements
- If maximal ventilation and problematic oxygenation, discuss “sea-level cabin”

Cardiovascular:

- Invasive arterial and CVP monitoring preferred
- Pressure monitoring set-up attached to pump **(not pressure bag)**
- Ensure all monitoring lines are air free (even small air bubbles will expand, coalesce & dampen trace)
- Absolute/ relative volume depletion will be unmasked during take-off. Raised ICP will be exposed at landing. Anticipate & manage pro-actively

Other:

- Decompress stomach with large bore nasogastric tube (NGT)
- NGT on open drainage
- Urinary catheter in situ on drainage. Catheter bulb filled with 0.9% sodium chloride/ water
- Any air-filled devices (e.g. air filled immobilisation splints) must be decompressed before take-off). Plaster casts must be split.
- Vacuum mattress must be re-vacuumed at altitude
- Temperature control measures prior to flying. Temperature will fall in dry, cool atmosphere of high altitude (-2°c per 300m~1000ft)

Remember:

- All equipment to have **adequate battery power** independent of the aircraft (store spare batteries separately to avoid leakage, take screw driver/ equipment need to change battery)

EQUIPMENT

- Equipment **CANNOT** be plugged in to a commercial airliner
- Check air ambulance **power supply**. It may be possible to use this power source.
- All equipment must be entirely self-sufficient on **own battery source**. Take spare batteries in orange pelicase.
- **All equipment must be securely strapped down during the flight including oxygen cylinders**
- All equipment taken must be **approved by the airline/ aircraft** for use (some electronics affect the airplane avionics)
- If **defibrillation** is required, **notify pilots** prior to activation
- **Air filled equipment:**
  - **Volume 30% greater at 8000ft** (~2500m)
  - **100% greater at 18000ft** (~5500m)
- Deflate and remove/ open BP cuff after use
- Vacuum mattresses will lose vacuum at altitude. Use as an air-filled mattress in flight or re-vacuum

OXYGEN CALCULATIONS

Oxygen requirement dependent on:

Total journey time (minutes) x ventilator or flow meter usage of oxygen (L/min)

Journey time calculation:

Hospital to ambulance	…..
Ambulance to airport	…..
Airport check-in and waiting time	…..
Flying time (including refueling time)	…..
Deplaning to ambulance	…..
Ambulance to accepting hospital	…..
Total	**….. (minutes)**

Ventilator usage of oxygen (dependent on pressures and oxygen concentration required)

Babypac	5-11L/minute
Ventipac & Oxylog 1000	10-15L/minute

Cylinder size & weight

Size	Usable capacity	4L/min	6L/min	8L/min	10L/min	Full weight
CD	460L	1h55	1h57	0h58	0h45	3.5kg
D	300L	1h15	0h50	0h35	0h30	5kg
E	600L	2h30	1h40	1h10	1h00	7.3kg
G	1000L	4h10	2h45	2h50	1h40	14.6kg
Q	2000L	8h20	5h30	4h10	3h20	32.7kg
H	6500L	27h00	18h00	13h30	11h00	69.8kg

Quick check oxygen consumption / CD cylinder size/ time table

Time in use	5 hours	10 hours	15 hours
8L/min (babypac)	6 cylinders	11 cylinders	16 cylinders
15L/min (oxylog)	10 cylinders	20 cylinders	30 cylinders

ALWAYS TAKE DOUBLE THE CALCULATED VOLUME OF OXYGEN REQUIRED

EMERGENCIES IN THE AIR

- Pneumothorax with ventilatory compromise
- Pulmonary bullae/ emphysematous lung with ventilatory compromise
- Obstructed bowel with ventilatory compromise, pain or perforation
- Obstructed sinuses with pain or rupture of tympanic membrane

Air in monitoring lines or giving sets will expand and coalesce

- Dampen monitoring trace, cause loss of waveform
- Cause irregular/ inaccurate delivery of infused drugs

Air in cuffs will expand

- Cause pressure necrosis of tracheal mucosa/ skin

Acceleration/ deceleration during take-off and landing can unmask relative/ absolute hypovolaemia causing hypotension

- Apply large directional force on all equipment and passengers

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