NHS Children's Acute Transport Service

Clinical Guideline

CATS Aeromedical Transfer (Clinical)

Document Control Information

Author	Lutman, Clement	**Author Position**	Head of Clinical Service, ANP
Document Owner	Polke	**Document Owner Position**	CATS Co-ordinator
Document Version	4		
First Introduced	July 2009	**Routine Review Schedule**	Every 2 years
Active Date	January 2018	**Next Review**	January 2020
Applicable to	**All CATS staff**		

Scope

This document describes the procedures to be followed for all air transfers.
(see also: General Aeromedical Considerations, Aeromedical Decision Making, Use of Inhaled NO aeromedical, Use of SAR for Air Transfers)

Guidance

A CATS consultant *must* approve all air transfers before transport is booked.

Air transfer should be considered for all referrals with a one-way journey time in excess of 2 hours. Air transfer will usually be necessary when retrieving from a centre separated by water (e.g. Channel Islands, Ireland etc.).

Methods

Helicopter (RW) are unpressurised and can operate from landing sites close to the hospital in many cases. This advantage means that they may be suitable for destinations such as into the Southwest or Midlands.
They have more weather restrictions than fixed wing aircraft (safe flight planning for weather is the responsibility of the pilot in command). Poor visibility and freezing conditions can prevent helicopter transport.
Bristow provides these transports with Search and Rescue Aircraft which will usually depart from Regents Park (military landing site). The helicopter environment makes monitoring and communication very difficult.
Flight following will be provided by the ARCC/MRCC Kinloss/Swannick.

Fixed wing (FW) are pressurised but require a landing facility. This restriction tends to reduce time advantage and results in fixed wing aircraft being reserved for more distant destinations in the North or Channel Isles. They have relatively fewer weather restrictions (safe flight planning for weather is the responsibility of the pilot in command).
Fixed wing flights usually depart from London City Airport, Biggin Hill airport, Stapleford Airfield or Northolt (See Maps). Flight following will be provided by the aircraft operator.

Preparation

Teams should coordinate with the duty consultant, flight operator and duty administrator to formulate a logistical plan.

The duty administrator will provide logistical support for connecting transportation and liaise with flight operators.

The CATS team leader will formulate a medical plan with the duty consultant and oversee the flight kit and consumables package.

Gas supply (oxygen and air)

The FW aircraft may carry oxygen on board. However this must be confirmed when requesting the aircraft. Check gas connector compatibility.

Calculation: Oxygen use must be calculated (please use oxygen calculation graph) with sufficient safety margin.

Babypac
For non-active PEEP modes assume 5 L/min. If Active PEEP is used, then consumption goes up to 11 L/min.

Oxylog 3000
Check consumption using referring patient settings via the display interface. Additionally consider power and number of backup batteries required.

STEP 1: Estimate the total air journey time for the patient
STEP 2: Add 1 hour for loading, unloading and taxi time
STEP 3: To provide a margin of error, carry twice the calculated volume on transport.

MV (see above) X total air journey time in minutes (including 1 hour extra) X 2

Cylinders
Oxygen cylinders come in a number of sizes and fittings. Never leave base without at least two cylinders, even if you have calculated that one will be sufficient.

The following sizes are suitable for transport:

D: 340L; suitable for moving between ambulance/plane and ward.
CD: 460L; integral Schraeder valve.
E: 640L; good for maintenance on board aircraft, fitted in the transport incubators
ZD: 605L; standard CATS portable cylinder

Monitoring

Philips IntelliVue X2 is the default monitor. Ensure spare lithium batteries are carried in the Yellow Battery Carry Case.
Carry the MRX defibrillator/pacer and backup monitoring cables.

There may not be any facility to provide back-up power on the aircraft, plug in to charge whenever the opportunity presents.

Infusion Pumps
Take six Braun Pumps. You should ensure that there is one spare so that substitution may be made in the case of failure of a pump supplying a critical infusion.

Aerosled

This consists of three parts, the **Clip Deck** (interface), the **Aerosled** (patient stretcher) and the **Aerosled Bridge** (monitor/vent equipment restraint). Please remember to take all the required components.

The patient will be packaged on the Aerosled and the equipment restrained using the flight bridge. The Aerosled is usually attached to an aircraft base unit (FW), a Clip Deck (Non CATS ambulance trolley interface/Bristow Helicopter) or the CATS trolley.
Check that the Aerosled has been matched to the aircraft base unit in use before departure. Non-standard interfacing can be achieved using the Clip Deck.

Staff Considerations

Dress: All staff must comply with the uniform policy. Staff are advised to take cold weather gear for aeromedical transports.

Safety: Do not at any time take any personal risks during an air transfer. You must follow the direction of the aircrew. In particular do no approach any aircraft until invited to by the crew. Clear and unambiguous communication is important, ask for clarification if there is anything you do not understand.

Stabilisation of a Patient for Air Transport

Airway and ventilation

Intubation: If you are in any doubt about the patient's respiratory status, you should intubate. Intubation in-flight could be technically very difficult and access to the patient/monitoring may be quite limited.

Fixation of ETT: Melbourne strapping must be employed to secure all ETTs

Gas expansion: See below for details.

Circulatory support and Infusions

Access: Two points of intravenous/ intraosseous access.

Inotropes: Each inotrope used or anticipated should be prepared as an infusion in sufficient quantities to last twice the anticipated journey time. Careful note should be taken of the time infusions are started and regular checks made on the progress of the infusion, as it is difficult to hear the pump alarms above the aircraft noise.

Decompression of Trapped Gas

ETT cuff: Manometry should be used on cuffed tubes. Bear in mind that an increase in altitude will cause cuff expansion which may risk tracheal mucosal integrity and descent will cause cuff deflation which may risk aspiration.

Chest: All pneumothoraces should be drained and connected to a Heimlich valve for transfer.

Head: Patients with an open head injury or recent neurosurgery (48 hours) should be transferred at **sea level cabin pressure.**

Abdomen: A naso/oro gastric tube must be passed in all patients. This should be left on free drainage in order to decompress the stomach as the external pressure drops. Free air in the peritoneal cavity should be drained.

Urinary Catheters: Ensure that cuffs are water filled (as is standard practice) to avoid expansion problems.

Thermal regulation: Attention must be paid to the patients' temperature like any other retrieval. However there is likely to be more time spent outside (Transferring hosp-ambulance, ambulance-aircraft etc.) which may become especially significant on cold days. Environmental temperature monitoring is undertaken at CATS.

Physical Safety

Patient: Every effort should be made to secure the patient whilst allowing sufficient access for clinical support. Babies <5kg transported in the Pod should be placed on the vacuum mattress and nested/packed in with nappies and blankets. Larger children should be transported with the Ambulance Child Restraint (ACR) -

Staff: All staff must take responsibility for their own safety. In particular aircraft must not be approached without explicit instructions from the pilots, aircrew or airfield ground staff. Approved lifting techniques must be employed when moving the incubator on or off the aircraft.
When you board the aircraft, the flight crew will brief you on safety procedures. You must give this your full attention and ask questions if you are unsure.
In the event of decompression you must ensure that you secure your own oxygen supply before tending to the patient – you will be of no use if you are unconscious!

Equipment: All equipment must be secured for take-off and landing and also during flight when not in use. It is never sufficient to hold onto something that might become a dangerous projectile in an emergency situation.

Physiology

Trapped gases

Enclosed gases obey Boyle's law: at constant temperature as the atmospheric pressure decreases the volume of enclosed gases increases. The table below illustrates the expected changes as an aeroplane ascends:

	Altitude	Atmosphere	Volume
	0 ft	1.0	1.00
	5,000 ft	0.83	1.20
	8,000 ft	0.77	1.33
	18,000 ft	0.50	2.00

Oxygenation

The partial pressure of oxygen in the alveolus (P_AO_2) is approximately equal to the arterial partial pressure of oxygen (P_aO_2) in a patient with normal lungs.
P_AO_2 can be derived by subtracting the partial pressure of water in the saturated gas and the partial pressure of CO_2 displacing the inspired gas at alveolar level.

As P_aO_2 is equal to atmospheric pressure (+ Pi when intubated) multiplied by its fractional content in the inspired gas. Therefore it can be seen that as atmospheric pressure drops (with altitude) so will P_AO_2 and therefore P_aO_2**.**

As a very rough guide P_aO_2 will halve during the ascent to 8000 ft in an unpressurised aircraft.