NETS WA

CLINICAL GUIDELINE	
Special Features of an Air Transport	
Scope (Staff):	Nursing and Medical Staff
Scope (Area):	NETS WA

Child Safe Organisation Statement of Commitment

The Child and Adolescent Health Service (CAHS) commits to being a child safe organisation by meeting the National Child Safe Principles and National Child Safe Standards. This is a commitment to a strong culture supported by robust policies and procedures to ensure the safety and wellbeing of children at CAHS.

This document should be read in conjunction with this DISCLAIMER

Neonatal aeromedical retrievals are challenging retrievals. Personnel undertaking these retrievals must have an understanding of the changes in physiology that occur within the human body during air transport with special consideration of the neonate. The most frequent problems are altitude induced whilst others relate to the aircraft itself.

Physiological Effects of Altitude

Altitude hypoxia

Background

- As altitude increases, the atmospheric pressure decreases leading to a fall in the partial pressure of oxygen at the alveolar interface.
- The percentage of oxygen at altitude remains 21% but the partial pressure of oxygen will decrease resulting in less oxygen delivery to the alveoli and relative hypoxia.
- At 8000ft (normal cruising cabin altitude) this decrease in pO_2 is the equivalent to 15% of oxygen at sea level. At this altitude, oxygen saturations will decrease to the low 90’s which will normally be well tolerated in normal healthy adults.
- In neonates with underlying cardiorespiratory conditions the decrease in oxygen saturations may be more pronounced. This can be treated by supplemental oxygen.

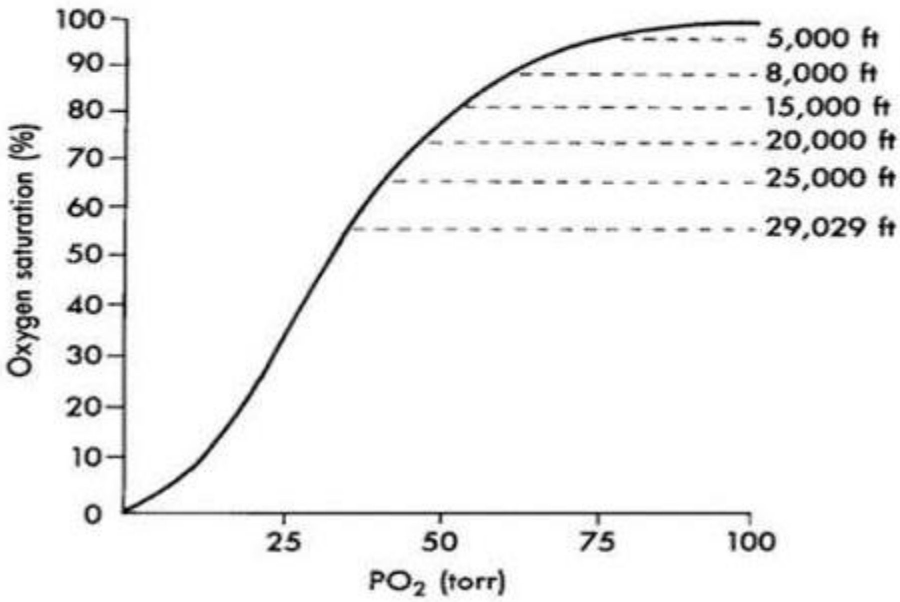

Fig 1: Oxygen Haemoglobin Dissociation Curve. Approximate oxygen saturations are marked for several altitudes [1]

Management

- A neonate may require oxygen during the flight even if oxygen saturations are satisfactory at sea level.
- Have supplemental oxygen ready to give if required – This can be given via nasal prongs, cot oxygen or by increasing the FiO_2 if on respiratory support.

Gas Expansion

Background

According to Boyles Law, gas will expand as altitude increases and atmospheric pressure decreases. Therefore, during aeromedical retrieval, gas expansion can adversely affect the patient, the crew and equipment. Any gas in an enclosed space (gut, lungs, sinuses, middle ear) will try and expand. Gas in an enclosed space will expand by around 20% with a change in altitude from sea level to 8000ft (normal cruising cabin altitude).

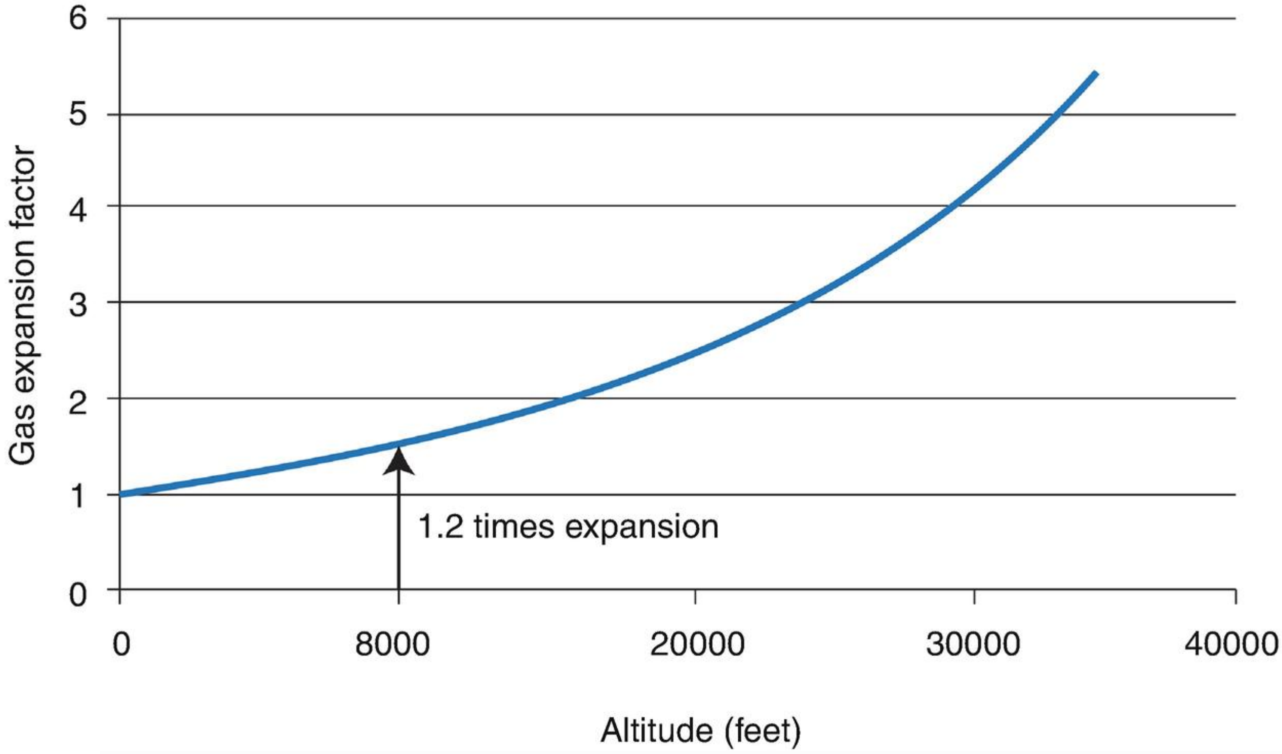

Fig 2: Impact of altitude on gas expansion. At the highest cabin altitude expected during flight in a pressurized aircraft (8000 feet), gas expands to 1.2 times the original volume [2]

This is important when transporting infants with the following conditions:

- Pneumothorax
- Bowel Obstruction
- NEC with pneumatosis/acute abdomen
- Congenital diaphragmatic hernia

Management

- Consider drainage of all pneumothoraces prior to transport. A small pneumothorax may expand at altitude causing clinical compromise. Chest drains should be positioned correctly, secured and attached to a portable Heimlich valve/ Pneumostat (fig 3).
- Insert nasogastric/ orogastric tube on free drainage if on respiratory support. Consider aspirating the stomach prior to transport in all neonates.
- Fill urinary catheter/ ETT cuff balloon with water and not air.

Fig 3: Heimlich valve (left) and Pneumostat (right)

Aircraft

Currently, NETS aeromedical retrievals are in partnership with RFDS or Medical Air. In the future, rotary wing retrievals will be an option.

- RFDS PC-12 - is the most common aircraft in the RFDS fleet and is usually used for retrievals in South West WA. Limited by the range of the aircraft.
- RFDS PC-24 - jet aircraft with ability to cover longer distances faster, allowing timely non-stop retrievals of the neonates from the NW of the state.
- Medical Air Lear Jet - jet aircraft used for timely, non-stop retrievals from the NW of the State or interstate transfers.

Do I need a sea level cabin?

Normal cruising altitude varies between 13- 40,000ft depending on length of flight and aircraft used. The corresponding cabin altitude is 6-8,000ft. Compressed air is pumped into the cabin to maintain the ambient altitude significantly lower than the flight altitude which creates a safe and comfortable environment for crew and patients. In a sea level cabin, there is additional pressurisation to maintain the atmospheric pressure inside the cabin similar to sea level/ original altitude which minimise the impacts of altitude induced hypoxia and gas expansion.

A sea level cabin may be required in the following circumstances:

- Critically unwell infant with high oxygen/ ventilator requirements e.g. MAS/PPHN
- Bowel obstruction
- Pneumothorax

But, there are disadvantages of a sea level cabin – aircraft are heavier, use more fuel, fly slower and lower and have a higher risk of turbulence.

Always discuss cabin requirements with the flight nurse and pilot prior to take off.

Environmental Stressors

Noise

Noise may represent the most difficult and troublesome stressors encountered in aeromedical retrievals. Communication between team members may be challenging but headsets will be provided.

Neonates will often be exposed to >80 dB during an aeromedical transport (Fig 4) compared to the recommended level of 45 dB in a Neonatal Intensive Care Unit. Excess noise can lead to stress and discomfort. Some infants such as those who are critically unwell/ extreme preterm are more vulnerable to noise than others. The neonatal incubator will decrease some exposure to noise but only by about 6dB.

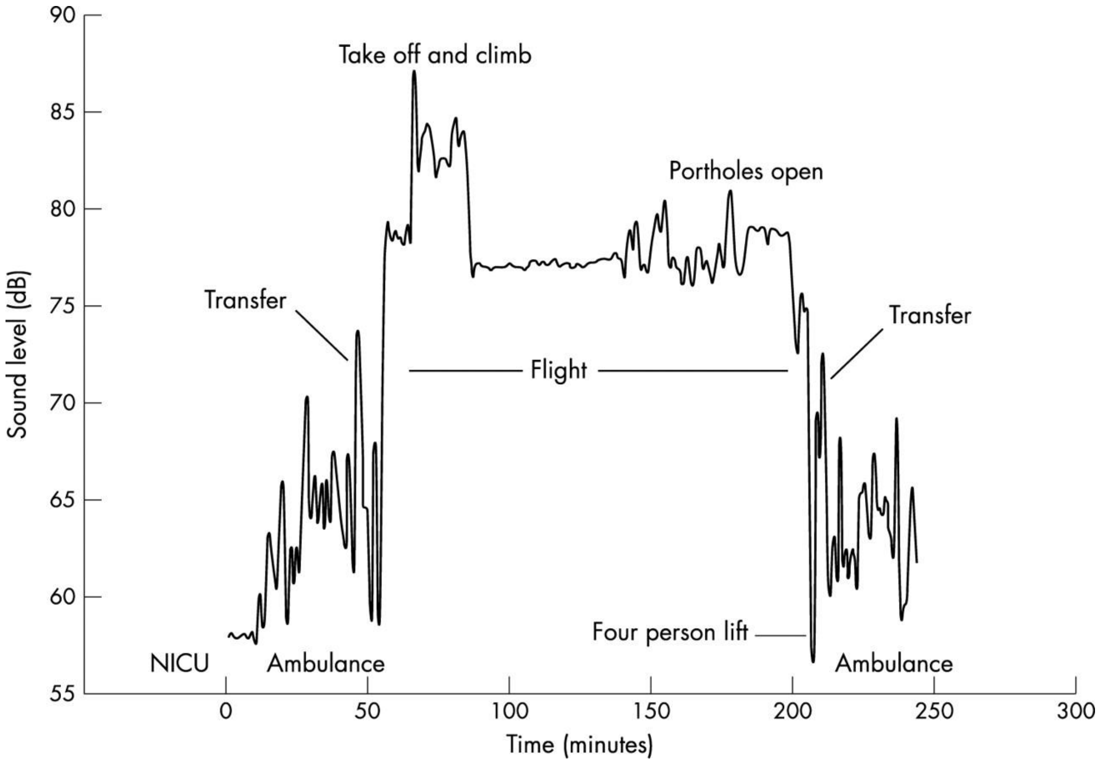

Fig 4: Sound level experienced during transport of a non-ventilated infant by air and road ambulance [3]

Management

- Ensure you apply ear muffs to every neonate – decreases noise levels by 7dB
- Noise may interfere with ability to hear monitor alarms therefore ensure they have a visual warning as well.

It is impossible to auscultate accurately therefore must rely on clinical acumen to assess patients – close monitoring of clinical observations, abdominal distension and discomfort levels.

Vibration

The most common source of vibration is the aircraft engines and turbulence. Vibration may interfere with equipment and monitoring.

Management

- Ensure the baby is well restrained in case of turbulence. Neonates can be restrained using the Neo-Restraint in the Voyager cot (fig 5) or single strap in the Mansell cot (fig 6).
- Use particular care if the neonate is muscle relaxed.
- Beware of acceleration and deceleration forces during take-off and landing – there may be pooling of blood in upper/ lower body which may cause bradycardia/ apnoea.
- Ensure all lines/ETT are well secured and insertion sites easily visible to allow continuous observation.

Fig 5: Voyager cot with NeoRestraint

Fig 6: Mansell Cot with single strap restraint

Temperature

Thermoregulation is critical in the transfer of the neonate. A neonate may be exposed to different temperatures whilst loading/ unloading of the aircraft despite the neonate being in an incubator e.g. a cold windy night in winter or hot summers day with sun streaming through the incubator glass. These effects can be minimised by covering the incubator with a blanket/cover but ensuring the baby can be seen at all times.

Special Clinical Considerations

Special consideration should be given to the cardiac neonate on prostaglandin infusion. Discussion should be held with the NETS Consultant on call regarding whether intubation is required prior to retrieval.

Medical Team considerations

- Aeromedical retrievals can be long and fatiguing.
- Ensure you have money/ bank card in case of unexpected delays.
- Consider taking a drink/snack with you.
- If you suffer from travel sickness, consider taking medication prior to travel.

All personnel need to be restrained and equipment securely stowed during the key phases of the flight (take off, landing and during any turbulence) which may limit rapid access to the patient. Anticipate the need for any deterioration and have the appropriate equipment easily accessible. Deterioration may not always be obvious in a noisy/ vibrating/ dimly lit environment.

References

1. Sutton JR et al. Operation Everest II:Oxygen Transport during exercise at extreme simulated altitude J Appli Physiol 64;1309:1988
2. Beninati W, Grissom T.E. (2019) Critical Care Air Transport: Patient Flight Physiology and Organizational Considerations. In: Hurd W., Beninati W. (eds) Aeromedical Evacuation. 2nd edition Springer p127-144
3. Buckland et al. Excessive exposure of sick neonates to sound during transport. Arch Dis Child Fetal Neonat Ed 2003;88:F513-516

Useful resources – Further reading

1. Martin T Aeromedical Transportation: A Clinical Guide 2nd edition Ashgate Publishing Ltd 2006

This document can be made available in alternative formats on request for a person with a disability.

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Compassion Excellence Collaboration Accountability Equity Respect

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