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HYPOXIC CHALLENGE 'FITNESS TO FLY' TESTING

Modern aircraft are pressurised to cabin altitudes of up to 2438m (8000ft) at which point the partial pressure of oxygen drops to the equivalent of breathing 15.1% oxygen at sea level. In healthy children this may cause baseline oxygen saturations to drop to as low as 90%. In patients with pre-existing lung disease hypoxaemia may be significant in this environment.

In patients with pre-existing lung disease supplemental oxygen should be used to maintain oxygen saturations above 90%. In children with pulmonary hypertension supplemental oxygen should be used to maintain oxygen saturations above 95%.

The consultant may decide to use spirometry, overnight oximetry, baseline oxygen saturations or a formal hypoxic challenge test as a pre-flight assessment.

A formal Hypoxic Challenge Test is assessed in the awake patient and is a short duration test. Extrapolating this to a sleeping child on a long-haul flight may be difficult. Decisions to recommend supplemental oxygen may therefore be empirical or may be based on a formal hypoxic challenge test.

BTS Guidelines recommend

- Ex-premature infants who develop respiratory infection should probably not fly under the age of 6 months after the expected date of delivery
- Infants with any history of neonatal illness and children with hypoxia due to chronic lung disease should undergo pre-flight assessment.
- Children with cystic fibrosis with FEV1 <50%pred should undergo a hypoxic challenge test.

Currently hypoxic challenges are performed by the paediatric respiratory physiologist at Llandough Hospital using a 40% venturi mask using Nitrogen as the driving gas. The entrained air dilutes the nitrogen producing a 15% oxygen mixture. Subjects breathe the hypoxic gas for 20 minutes or until equilibration. Oxygen saturations and heart rate are monitored throughout. If saturations drop below 90% supplemental oxygen is added via nasal cannula. The protocol for this test is outlined below.

Protocol for Hypoxic Challenge for children aged >4 years:

- Measure SpO_2 and heart rate at rest in air.
- Place on nasal cannula ready for supplemental oxygen if needed.
- Place 40% venturi mask over the top of nasal cannula.
- Venturi mask is connected to 100% Nitrogen cylinder which is then opened to 10L/min flow for 20 minutes.
- Monitor SpO_2 for 20 minutes. If baseline SpO_2 <85% initiate 2l/min supplemental oxygen immediately. If oxygen saturations remain between 85-100% complete the 20 minute monitoring period.
- If after 20 minutes baseline SpO2 <90% (or <95% in a patient at risk of pulmonary hypertension) introduce 2L/min oxygen via nasal cannula and repeat for another 20 minutes or until equilibration.
- If after 20 minutes baseline SpO2 remains <90% (or <95% in a patient at risk of pulmonary hypertension) on 2L/min increase supplemental oxygen to 4L/min and repeat for another 20 minutes or until equilibration.

Conclusions

- If SpO2 <90% on 4L/min supplemental oxygen the patient may be unfit to fly.
- If SpO2 <95% on 4L/min supplemental oxygen in a patient with pulmonary hypertension, the patient may be unfit to fly.
- Airlines only provide supplemental oxygen at 2L/min and 4L/min.

References:
BTS Statement: Thorax 2002;57:289-304; Cramer et al. Thorax 1996;51:202-203; Udomittipong et al. Thorax 2006;61:343-347.

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