There are 16 helicopter emergency ambulance services covering the whole country with reported average response times of 17 minutes and transfer times of 10 minutes. The decision to use a helicopter is not straightforward and the transfer of a seriously injured patient by helicopter may be hazardous and transportation by road may often be a safer option. There are various guidelines for the appropriate use of helicopters to transport patients. [1, 2, 3] Algorithms have been developed to analyse those trauma patients who do not require spinal immobilisation before transfer via helicopter but one study found these to be unhelpful. [4]

Response times can be improved by using a network of helicopter ambulances across regions. [5]

Advantages [6]

- Speed over long distances. Road transit times are halved for distances 50-200km.
- Access to remote areas eg mountainous areas, over large water expanses.
- Indicated for severely ill/unstable patients - eg trauma score<12, GCS<10, systolic BP<90mmHg, respiratory rate >35, heart rate>120, AVPU (Alert, Voice, Pain, Unresponsive scale) below V.
- Enable early initiation of management by highly trained medical staff and with special equipment.
- Faster mobilisation than fixed-wing aircraft.
- Needs smaller landing space and can land closer to or at hospitals.
- One study found that air ambulances offered distinct advantages in the management of patients with traumatic brain injury. [7]

Disadvantages and essential precautions [6]

- Staff training: minimum requirements include safety training, evacuation procedures for the aircraft and basic on-board communication skills. Staff must also have a detailed knowledge of how medical conditions can be affected by helicopter transport. [8]
- Crashes: the risk is greatest at night and in poor weather conditions. [9] However, one study of aeromedical accident rates during emergency retrieval in Great Britain found no deaths during helicopter transport between 1999-2004. [10]
- Primary scene retrieval (where the helicopter lands at the scene of the incident) is involved in more crashes than if the helicopter landed at an airport or hospital. [6]
- Expensive: helicopters are the most expensive form of patient transport and there is continued uncertainty about the cost-effectiveness. There is, however, good evidence for their benefit in serious blunt trauma patients.
- Noise and general stress: may lead to anxiety and disorientation and hamper communication.
- Vibration, exacerbating bleeding/pain from fracture sites.
A fall in barometric pressure may lead to hypoxaemia. However hypoxia is unlikely unless there is cardiac or lung disease, anaemia, shock or chest trauma, as helicopters rarely fly high enough.

A fall in barometric pressure also leads to an increase in the volume of gas-filled cavities. Decompression sickness ('the bends'), pneumoperitoneum and intracranial air are relative contra-indications to air transport. Tissues may also swell and plaster casts should be split. Dehiscence of abdominal wounds (therefore avoid flying for 10 days after surgery if possible) and renewed bleeding from a peptic ulcer.

Oxygenation, airways and ventilation will need to be secured, as will catheters, tubes and drains. IV access will need to be stabilised. Plastic bags may distend, drips may slow down and an extra line may be a necessary precaution.

Blood volume deficit should be corrected before transport.

Medication issues that may need to be considered include analgesia, sedation, prophylactic antiemetic and prophylactic anticonvulsant.

Increased altitude is also associated with a fall in temperature. Patients should be laid on and wrapped in insulating cellular blankets or bubble wrap underneath warm blankets or duvets. Neonates will need incubators.

In normal patients little effect of decreased partial pressure of inspired oxygen ($F_iO_2$) as $SaHb>90\%$ at alt<2500m.

However may have effect if decreased++ $p_iO_2$, decreased haemoglobin<75g/L, decreased $p_aO_2$, increased $O_2$ requirement, fixed cardiac output.

In severe respiratory disorders (eg ARDS) may not be able to maintain oxygenation at 100% fractional inspired oxygen ($F_iO_2$) at altitude so fly at lower alt or increased pressurisation (ideally sea level).

Gas expansion: Volume doubles at 5000m. If not room for expansion then increase pressure in cavity (eg relevant in fractured skull with aerocoele, penetrating eye injury, recent gut sutures).

Aircraft limitations, eg weather, landing site, limited carriage space (especially if additional medical personnel).

Issues concerning specific injuries/conditions include:

- Cervical spine stabilisation - special braces need to be used as sandbags are mobile.
- A prophylactic intercostal catheter may need to be considered if there is any pneumothorax or more than two ribs are fractured as a pneumothorax may expand at altitude. Heimlich valves rather than underwater drains should be used.
- Haemorrhage should be controlled.
- Fractures should be splinted (preferably without air splints).
- Bivalve plasters should be used prior to ascent.

Noise and vibration: may cause nausea, pain and motor dysfunction. Ear protectors should be worn and intercom headphones should be used for essential communication.

Visibility: may be limited and may hamper observation of both the patient and monitor.

Communication should be maintained with the sending and receiving hospitals, the patient and the relatives.

The risks of transport should be explained to the patient/relatives; written consent should be considered.

Equipment considerations should include weight, portability, attachment to the aircraft, visible alarms, battery compatible to the electronic system of the aircraft.

Pre-empt predictable problems, eg line-tube dislodgement during loading/unloading, thermal insult, re-bleeding.

Contra-indications

These include:

- Patient in full arrest
- Terminally ill patient
- Active untreated communicable disease that would put the crew at risk
- Uncontrollable, combative patient
- Patient of sound mind who refuses transfer
• Unstable patient, who requires a procedure (ie laparotomy) which could be performed at the sending centre
• Stable patient in whom another means of transport would be more appropriate
• Bronchopleural fistula
• Bowel surgery with the last 10 days
• Active gastro-intestinal bleeding
• Vascular anastomosis within the last 14 days

Further reading & references

3. Lifeflight of Maine; Guidelines for helicopter transport.
8. The Intensive Care Society; Guidelines for the transport of the critically ill adult. 2002.

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