

Definition

Process of transferring critically ill patients using a team which travels to the patient location from a central location or the destination hospital. The principles of medical retrieval are to:

- Supply a level of medical expertise akin to that of the destination hospital.
- Assess the clinical problem in the place of referral.
- Stabilise the patient's condition prior to transportation.
- Transport the patient with physiological support & appropriate monitoring.
- Deal with foreseeable en route deteriorations as the working environment allows.
- Monitor and review the quality of the retrieval process.

General considerations

Select patient

- No abs CI to air medical transfer as long as appropriate precautions taken.
- Relative CI to air retrieval:
 - Bronchopleural fistula
 - Bowel surgery <10d
 - Active GI bleeding
 - Vascular anastomosis <14d
- Benefit of transport must outweigh increased risks of transport.
- Must require care available at destination not available at source facility.
- Necessary care must be able to be provided during transport.

Select mode of transportation

- Road vehicle
 - Standard ambulance
 - High level care ambulance (Paramedic staff) ± Nursing/medical staff
 - Specialist retrieval team + vehicle
- Air medical
 - Helicopter
 - Indications for 1^o helicopter retrieval: trauma score <12, GCS <10, BP_{sys} <90mmHg, 10 > RR >35, 60 > HR >120, AVPU below V.
 - Halves road transit time for distances 50-200km.
 - Good for poorly accessible areas - mountainous/over large water expanses
 - Faster mobilisation than fixed-wing
 - Needs smaller landing area & can land closer to or at hospitals
 - Cabin cons: noise level/communication, size limitation, cramped, temperature control, vibration, unpressurized
 - Safety: approach wrt rotors.
 - Fixed-wing
 - Distances >200km or road transport times >3h
 - Unpressurised if <900km light aircraft at alt to 3000m
 - Pressurised (usually to 2000m) if >900km turboprop/jet at alt to 8000m+
 - Pros compared to helicopter: faster airspeed, more cabin space, less noise/vibration, better temp control
 - Cons: longer mobilisation time, long landing strip, requires road transport from landing area to hospital

Select Medical Team

From:

- Doctor - ED, intensivist, or anaesthetist
- Nursing
- Paramedic/s
- Ambulance officer/s

Patient Preparation

Secure

- Airway, ventilation, oxygenation
- All catheters, tubes, drains
- IV access (tape/splints as req) + extra access (min 2 large bore)

Sedation/Analgesia

- Sufficient stock for increased req during transport
- Prophylactic antiemetic (risk of vomiting from medication, condition, or motion)
- Prophylactic anticonvulsant (if fitting risk)

IV Fluids

- Ensure blood volume deficit corrected before transport
- Ensure sufficient stock for transit
- At altitude plastic bags distend & IV s often slow/stop so may need freq flushing

Injuries/conditions

- C-spine stabilisation: special braces - avoid sandbags as mobile
- Consider prophylactic ICC if any pneumothorax or >2 rib # as PTX expands at altitude
- Use Heimlich valves rather than underwater drains for ICC
- Haemorrhage controlled
- Splint # preferably without air splints
- Bivalve plasters prior to ascent

Environment

- Temp likely to fall during transport (esp aircraft)
- Core T monitoring
- Incubators for neonates

Communication

- Ensure patient, relatives, sending/receiving hospital teams all kept informed
- Mobile phone / in-aircraft radio

Documentation

- Notes, investigation results, XRs
- In-transit notes/obs
- Consider consent for transport due to increased risks

Equipment

- Need defib, oxygen & suction.
- Kit should be light, portable, and attachable to fixtures of vehicle/aircraft.
- Alarms should be visible and audible.
- Electronics: Battery containing and compatible with electrical system of vehicle/aircraft.
- Monitors: ECG/cardiac, oximeter, ET CO_2 , NIBP (auto) or intra-arterial BP, thermometer
- ETT: remove some air from cuff on ascent & re-instil on descent, humidification needed.
- Ventilator: robust, know gas consumption (Oxylog: min vol + 800ml/min), sufficient O $_2$
- Drugs & fluids: Infusion or syringe (ideally) pumps, pre-packed syringes, full resus packs

Anticipated In-Transport Problems

Ideally preparation avoids need to deal with problems in transit.

Loading/unloading: line-tube dislodgement, thermal insult, re-bleeding

Altitude effects:

- In normal patients little effect of $\downarrow p_iO_2$ as SaHb > 90% at alt < 2500m.
- However may have effect if $\downarrow\downarrow p_iO_2$, $\downarrow [Hb] < 75g/L$, $\downarrow p_aO_2$, $\uparrow O_2$ req, fixed cardiac output
- In severe respiratory disorders (e.g. ARDS) may not be able to maintain oxygenation at 100% FiO_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 $\uparrow P$ in cavity.
- Expansion relevant in:
 - Patient (generally may CI air retrieval unless can fly at low cabin altitude)
 - # skull with aerocele
 - Penetrating eye injury
 - Mediastinal emphysema, pneumothorax
 - Recent gut sutures, bowel obstruction
 - Decompression illness/air embolism
 - Equip:
 - IV bags
 - ETT cuff
 - Colostomy bag
 - MAST suits
 - Staff: sinuses, middle ear
 - Solutions: Heimlich valve for ICC, vent cavities e.g. NGT, give 100% O_2 , deflate ETT cuff while at alt.

Temperature: Keep patient warm but ensure coverings don't obscure patient/hamper access

Noise, vibration & G forces: Detrimental to recent vascular anastomoses or re-expanded PTX, unstable patients, comfort/pain level, haemostasis, IV insertion, auscultation, communication.

Positioning & Space: Ideally (but often impossible) in HI/ \uparrow ICP: head forwards on take-off, opp on landing. Space limitations for access, procedures.

Vital signs: Difficult to monitor due to noise/vibration, may need visual signs/alarms instead of audible ones. Monitor accuracy at altitude or with vibration.

Crash/Emergency landing: Trained crew

Other: Motion sickness, sinus/middle ear pressure, phobias (height, flying, enclosed spaces)