



9 Guidelines for the transport of the critically ill adult

STANDARDS AND GUIDELINES

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Transport of the critically ill adult

1 INTRODUCTION

- 1.1 The Intensive Care Society first published guidelines on the transport of the critically ill adult in 1997¹. These attempted to rationalise advice from a number of sources and encourage an improvement in standards of care during patient transport in the UK. The Department of Health's publication 'Comprehensive Critical Care'² lists a number of recommendations regarding the transfer of critically ill patients and makes the development of transport protocols a priority. The Intensive Care Society has therefore reviewed its guidelines on transport in order to provide its members with up to date advice.
- 1.2 Guidelines have previously been published by a number of organisations including the American College of Critical Care Medicine³, the Australian and New Zealand College of Anaesthetists^{4,5}, and the Neuroanaesthesia Society of Great Britain and Ireland⁶. These revised Intensive Care Society guidelines draw on these and other published works.
- 1.3 These guidelines apply to the transport of critically ill adult patients in the UK outside of the normal critical care environment. They apply both to patients transferred between hospitals, and to patients moved between departments within a hospital (e.g. from the intensive care unit to magnetic resonance or computed tomography scanner) since the same level of preparation, supervision and care is required for each. They are not intended however to apply to truly mobile intensive care units, as for example, operated by the military services.
- 1.4 Standards of practice for the transport of the critically ill child have been published by the Paediatric Intensive Care Society⁷.

2 SUMMARY

- 2.1 Critical Care Networks and transfer groups have been established according to national directives (paragraph 4.1–4.3).
- 2.2 There is evidence that the outcome of critically ill patients is improved by the use of dedicated transport teams. Critical Care Networks should therefore consider the development and use of dedicated transport teams (paragraph 5.1–5.2).
- 2.3 All acute NHS hospitals must retain the ability to resuscitate, stabilise and transport critically ill patients. Hospital transport teams should be developed. These should be appropriately trained, resourced and supervised. A senior clinician and nurse within each hospital should be responsible for the organisation and development of these teams (paragraph 6.1–6.3).

- 2.4 Each hospital should have a designated consultant available 24 hours a day to organise, supervise and where necessary undertake all inter-hospital transfers (paragraph 6.4).
- 2.5 Critical Care Networks should consider the provision of appropriately equipped ambulances to facilitate the transport of critically ill patients. These should be designed with attention to the needs of both patients and staff (paragraph 7.1–7.3).
- 2.6 Each critical care area should have access to a dedicated, suitably equipped transport trolley compatible with local ambulance mounting systems (paragraph 8.1–8.3).
- 2.7 Appropriate transport equipment including monitors, ventilators and syringe pumps must be available. Ideally all equipment across a Critical Care Network should be standardised to enable the seamless transfer of patients between hospitals without interruption of drug therapy or monitoring (paragraph 8.4–8.9).
- 2.8 Critically ill patients should be accompanied by at least two suitably experienced attendants, one of which should be a medical practitioner with appropriate training in intensive care medicine, anaesthesia or other acute speciality (paragraph 9.1–9.4).
- 2.9 The decision to transfer a patient to another hospital is always a balance of the associated benefits and risks, and must be made by a consultant in intensive care in discussion with consultant colleagues from the referring and receiving units. The final decision to accept a patient lies with the ICU consultant in the receiving unit (paragraph 10.1–10.4).
- 2.10 When transfer is required for capacity reasons, guidelines on which patient to transfer have been previously published by the Department of Health (paragraph 10.5–10.6).
- 2.11 The most appropriate mode of transport will be influenced by factors such as urgency, distance, weather conditions and availability. Transport by road is easier, cheaper and more familiar to staff. Helicopters should be considered for longer journeys or where road access is difficult. Fixed wing aircraft should be considered for journeys over 150 miles (paragraph 12.1–12.6).
- 2.12 Patients should generally be meticulously resuscitated and stabilised prior to transport. Patients with penetrating trauma or acute ruptured aortic aneurysm may be exceptions (paragraph 13.1–13.16).
- 2.13 The minimum standards for monitoring during transport include continuous presence of appropriately trained staff, ECG, non-invasive blood pressure, oxygen saturation, end tidal carbon dioxide and temperature. Invasive blood pressure measurement through an indwelling arterial cannula should be used in most cases (paragraph 14.1–14.2).
- 2.14 In mechanically ventilated patients, the oxygen supply, inspired oxygen concentration, ventilator settings and airway pressure should also be monitored (paragraph 14.6).
- 2.15 Safety is paramount. The patient should be secured in the transport trolley by means of a harness, and all equipment fastened to the trolley or securely stowed in lockers. Unnecessary high speed transfers should be avoided. Staff should remain seated at all times (paragraph 15.1–15.6).

- 2.16 Transport of patients by air presents attendant staff with many problems relating to the unfamiliar environment, noise, vibration, poor access and visibility, and the effects of altitude. Staff should not undertake aeromedical transport without appropriate training (paragraph 16.1–16.7).
- 2.17 On arrival at the receiving unit there should be a verbal and written hand-over to the receiving medical and nursing team (paragraph 17.1–17.2).
- 2.18 Clear notes must be maintained at all stages. Standard transport documentation should be developed for use across Critical Care Networks (paragraph 18.1–18.2).
- 2.19 Critical Care Networks should develop comprehensive quality assurance programmes including audit and critical incident reporting. The clinician in each hospital responsible for the organisation of hospital transport teams should ensure that all patient movements within the hospital are subject to similar scrutiny (paragraph 19.1–19.3).
- 2.20 All individuals involved in the transport of critically ill patients should be suitably trained and experienced. Competency based training and assessment should be developed (paragraph 20.1–20.3).
- 2.21 Despite precautions there is always the possibility of an ambulance being involved in an accident. The insurance situation in these circumstances is complex and staff should ensure that they have appropriate insurance cover (paragraph 21.1–21.3).

3 BACKGROUND

- 3.1 Primary transfer in the UK (from the site of injury or illness to hospital) is generally performed by trained paramedics using conventional road ambulances, occasionally supported by medical teams called out from a local hospital or general practice.
- 3.2 Following initial resuscitation and stabilisation critically ill patients may require secondary transfer. Indications for such transfers include:
- Specialist intervention not available in referring hospital
 - On-going support not available in referring hospital
 - Specialist investigation not available in referring hospital
 - Lack of staffed intensive care bed in referring hospital
 - Repatriation.
- 3.3 In 1997 it was estimated that over 11,000 critically ill patients were transferred in the UK each year and this figure has almost certainly increased⁸. The aim should be to undertake each transfer as safely as possible, and this may be best achieved by dedicated transport teams⁹⁻¹².
- 3.4 At the present time, secondary transport services in the UK are poorly co-ordinated. Equipment provision and training remain inadequate¹¹. Many critically ill patients are transferred between hospitals in an ad hoc manner by inexperienced trainees¹³ with little formal supervision and potentially serious complications may occur^{14,15}.
- 3.5 The publication ‘Comprehensive Critical Care’² makes planning for inter-hospital transfer of the critically ill mandatory at local, regional and national level. Transport services should be explicitly organised and co-ordinated to deliver safe, efficient and timely inter-hospital transfer. They should encompass the transfer of all critically ill or injured patients and not just those from within traditional high dependency or intensive care units.

4 DEVELOPMENT OF CRITICAL CARE NETWORKS

- 4.1 Critical Care Networks are responsible for the co-ordination and development of transfer services within defined geographical areas. Each network will have a lead clinician and manager whose responsibilities include the development of referral pathways, transfer protocols and quality assurance programmes.
- 4.2 Within each network, individual hospitals are required to define those geographically related units to which they will transfer patients for capacity reasons alone. These 'transfer groups' are specific to each hospital and arrangements may not necessarily be reciprocal. Hospitals at the boundaries of network areas may form a transfer group, which includes adjacent hospitals in the neighbouring network, and if appropriate, use a different tertiary referral centre from their parent Critical Care Network. Close co-operation between adjacent Critical Care Networks is therefore desirable.
- 4.3 Within each Critical Care Network there should be regular meetings of relevant consultants, senior nurses, ambulance providers, bed bureaux managers and local healthcare commissioners. This group should:
- Develop admission and discharge policies, referral policies and transport protocols.
 - Ensure appropriate resources are available to enable the transfer of critically ill patients to be undertaken in a timely and safe manner.
 - Develop quality assurance programmes.
- 4.4 Healthcare commissioners must ensure that sufficient funds are made available to meet these goals.

5 TRANSPORT ARRANGEMENTS WITHIN CRITICAL CARE NETWORKS

- 5.1 There is evidence that the use of dedicated transport teams improves the outcome of critically ill patients transferred between hospitals¹⁰⁻¹². Critical Care Networks should therefore consider the development and use of dedicated transport teams.
- 5.2 Transport teams may be based at a centrally located tertiary referral centre (retrieval team), affiliated to an individual Critical Care Network (regional transport team) or based in individual hospitals (hospital transport team). Arrangements will depend upon geographical area, funding and demand. A fully integrated transport system might however make use of all three approaches.
- 5.3 Regional bed bureaux^{F1} should be actively involved with networks in the co-ordination of secondary transfer of critically ill patients. They should be able to identify the locality, numbers and types of beds available within a network. Systems should also be in place to locate beds beyond the network boundaries when necessary.

^{F1} EBS (Emergency Bed Services) serving South of England, ICBIS (Intensive Care Bed Information Service) serving the North West of England, WYMAS (West Yorkshire Metropolitan Ambulance Service) serving West Yorkshire, and NICBIS (Northumbrian Intensive Care Bed Information Service) serving the North East of England. The Scottish Ambulance Service operates a similar service.

6 ORGANISATION WITHIN TRUSTS

- 6.1 Whatever transport arrangements Critical Care Networks develop, all acute NHS hospitals must have systems in place to resuscitate, stabilise and transport critically ill patients.
- 6.2 Hospital transport teams should be developed to provide for the movement of critically ill patients both within the individual hospital and beyond, if regional transport teams are unavailable or inappropriate. A senior clinician and nurse within each hospital should be responsible for the organisation and development of these teams.
- 6.3 Hospital transport teams should consist of identifiable, appropriately trained staff, with appropriate equipment and resources. They should use the same protocols and meet the same standards as other transport teams within the Critical Care Network.
- 6.4 Within each hospital, a named consultant should be available 24 hours a day to arrange, supervise and where necessary undertake all inter-hospital transfers. This might normally be the consultant on call for intensive care.
- 6.5 Each hospital should have arrangements in place to ensure that transfers for capacity reasons alone occur **only as a last resort**. Where necessary transfer should be to the most appropriate hospital for the clinical needs of the patient, while taking account of bed availability and transfer distance. Likely receiving hospitals should be included in the referring hospital's designated transfer group. In keeping with 'Comprehensive Critical Care'², any transfer solely on the basis of capacity that occurs beyond this will be classified as an adverse event.

7 VEHICLE SPECIFICATIONS

- 7.1 Critical Care Networks should liaise with ambulance providers to determine how best to meet the transport needs of the network. Where workload justifies it, the use of dedicated specially adapted ambulances can offer many advantages over standard vehicles, including preferred layout, augmented gas and power supplies, and permanent storage of equipment. Where dedicated vehicles are used responsibility for equipping, checking, replenishing and maintenance needs to be defined.
- 7.2 Vehicles should be designed and equipped with particular attention to the comfort and safety of both patients and staff. Ambulance providers should be consulted in the choice of equipment that may be used in transfer. Design considerations are given in Table 1.
- 7.3 Each Critical Care Network will need to define how intensive care vehicles are deployed and appropriate response times. One model is to have a number of vehicles stationed at strategic points around the network. When required, an emergency ambulance crew can be dispatched to collect the intensive care vehicle before attending the referring hospital. Using this approach it may be possible to achieve an intensive care ambulance for urgent secondary transfer anywhere in the area within 30 minutes. Other models may be appropriate for different situations.
- 7.4 Standards for air ambulances are stipulated by the Civil Aviation Authority (CAA). Expert advice should be sought from ambulance services and commercial aircraft providers in planning air transport services.

TABLE 1: Design considerations for intensive care ambulances**Vehicle**

- Driven by suitably trained personnel
- Able to carry up to four members of hospital staff in addition to ambulance crew
- Seats for staff should ideally be rear facing or forward facing (not side facing)
- Seats to be fitted with head restraints and three point inertia reel seat belts
- Hydraulic ramp, winch or trolley system designed to enable single operator loading
- Patient trolley centrally mounted allowing all round patient access
- Stable comfortable ride with minimal noise and vibration levels
- Regular service and maintenance contracts

Services

- Standard 12-volt DC supply. In addition:
240-volts 50Hz AC power supply from an inverter or generator
(Recommended minimum output 750 watts. This is generally sufficient to power a portable ventilator, monitor and infusion pumps)
Minimum of two standard 3 pin 13 amp outlet sockets in the patient cabin
- Minimum of two F size oxygen cylinders in secure housings*
Manifold system with automatic cylinder change over, and audible oxygen supply failure alarm
Minimum of two wall mounted outlet valves for oxygen
(Oxygen concentrators may be an alternative)
- Medical air supply is also desirable but the space required by additional cylinders or compressors may be a limiting factor
- Adequate lighting, heating, air conditioning and humidity control

Equipment

- Mobile telephone to enable communication with referring/receiving hospital
(Compatibility with medical equipment to be ensured)
- Defibrillator and suction equipment
- Adequate storage and stowage for ancillary equipment

* Duration of oxygen supply will depend upon rate of usage. Escorting personnel should always ensure that there is sufficient oxygen available for each journey undertaken.

8 EQUIPMENT

- 8.1 Standard ambulance trolleys are generally unsuitable for the transport of critically ill patients, because of difficulty securely mounting all the necessary medical equipment.
- 8.2 Each critical care area responsible for transporting patients should have access to at least one dedicated transport trolley. This should be chosen in consultation with the ambulance service and be compatible with the trolley mounting system in the ambulance. Trolleys should be designed or adapted to carry monitors, syringe pumps, ventilators and reserve oxygen cylinders. There should also be anchorage for a five point patient harness.
- 8.3 As much of the equipment as possible should be mounted at or below the level of the patient. In particular, large arrays of vertical drip stands should be avoided. This allows unhindered access to the patient and improves stability of the patient trolley.

- 8.4 Ideally all equipment within a Critical Care Network should be standardised to enable the seamless transfer of patients without, for example, interruption of drug therapy or monitoring due to incompatibility of leads and transducers.
- 8.5 All equipment should be robust, durable and lightweight. Electrical equipment must be designed to function on battery when not plugged into the mains. Additional batteries should be carried in case of power failure. Battery life should be maximised by exercising batteries in compliance with the manufacturer's recommendations.
- 8.6 Portable monitors should have a clear illuminated display and be capable of displaying ECG, arterial oxygen saturation (SaO₂), non-invasive blood pressure, three invasive pressures, capnography (EtCO₂) and temperature. Alarms should be visible as well as audible in view of extraneous noise levels.
- 8.7 Portable mechanical ventilators should have as a minimum disconnection and high pressure alarms, the ability to supply positive end expiratory pressure (PEEP) and variable inspired oxygen concentration (FiO₂), inspiratory/expiratory (I/E) ratio, respiratory rate and tidal volume. In addition the ability to provide pressure controlled ventilation, pressure support and continuous positive airway pressure (CPAP) is desirable.
- 8.8 Gravity feed drips are unreliable in moving vehicles. Sufficient syringe or infusion pumps are required to enable essential fluids and drugs to be delivered. Pumps should preferably be mounted below the level of the patient and infusion sets fitted with anti-siphon devices.
- 8.9 Portable warm air devices for maintaining patient temperature can be useful and can also be mounted on the patient trolley.
- 8.10 Additional equipment for maintaining and securing the airway, intravenous access, etc should also be available (Appendix 1).
- 8.11 High visibility clothing, a mobile telephone, contact telephone numbers, money/credit cards should be available for use in emergencies.

9 ACCOMPANYING PERSONNEL

- 9.1 A critically ill patient should be accompanied by a minimum of two attendants. The precise requirement for accompanying personnel will depend upon the clinical circumstances in each case.
- 9.2 One attendant should be a medical practitioner with appropriate training in intensive care medicine, anaesthesia, or other acute specialty. They should be competent in resuscitation, airway care, ventilation and other organ support. They should have had previous experience of transport in a supernumerary capacity, have demonstrated competencies in transport medicine and be familiar with the transport equipment.
- 9.3 The responsible medical practitioner should be accompanied and assisted by another suitably experienced nurse, paramedic or technician, familiar with intensive care procedures and with the transport equipment.

- 9.4 In most cases, the second attendant will be a nurse with independent professional responsibility towards the patient. Nursing staff should be appropriately qualified and experienced. They should ideally hold a post registration qualification in critical care which should have included educational elements on the transfer of critically ill patients. Advanced cardiac life support (ACLS) certification is also useful.

10 TRANSFER DECISIONS AND ETHICS

- 10.1 The decision to transfer a patient to another hospital must be made by a consultant responsible for intensive care, in conjunction with consultant colleagues from relevant specialities in both the referring and receiving hospitals. This is always a balance of the associated risks and benefits.
- Risks to the patient arise from potential deterioration of the underlying medical condition, the physiological effects of movement (tipping, vibration, acceleration and deceleration forces) and changes in barometric pressure and temperature associated with air transport. There are also risks to both the patient and staff from accidents associated with any mode of transport.
 - Benefit may be obvious where life saving intervention will be undertaken at the receiving hospital, but is less clear cut where the patient's medical condition is stable and the primary indication is lack of an available critical care bed at the referring hospital.
- 10.2 The decision to accept a transferred patient must be made by a consultant responsible for intensive care at the receiving hospital.
- 10.3 The transfer process is therefore the joint responsibility of the referring and receiving clinicians. The medical staff at the receiving unit may offer advice on patient management; however responsibility for the patient always lies with the clinician in attendance who may, if circumstances change, decide not to transfer the patient.
- 10.4 When a transfer is necessary because there are no available intensive care beds it may be appropriate to consider whether to move a new and potentially unstable patient or a patient currently on the unit who is more stable and less likely to deteriorate. In general, no patient should be subjected to an intervention that is not in their best interest. It could be considered unethical therefore to transfer one patient out of a critical care unit for the sole purpose of making room for another. This may on occasion, however, be the most pragmatic approach. The Department of Health published guidelines on admission to and discharge from critical care areas in 1996¹⁶ and these are summarised in Appendix 2.

11 WHETHER TO RETRIEVE OR SEND THE PATIENT

- 11.1 The decision whether to use a regional transport team or hospital transport team to carry out a transfer will depend upon network protocols, availability, and the degree of urgency.
- 11.2 If a regional transport team is not available or the delay caused by waiting for the arrival of a regional team may compromise patient outcome, a hospital based transport team must be used.

12 SELECTION OF TRANSPORT MODE

- 12.1 The selection of transport mode should take into account:
- The nature of the illness
 - Urgency of transfer
 - Availability of transport
 - Mobilisation times
 - Geographical factors
 - Traffic and weather conditions
 - Cost.
- 12.2 Road transport has the advantage of low overall cost, rapid mobilisation time, less **disruption from** adverse weather conditions, less potential for physiological disturbance and easier patient monitoring. Staff are also more familiar with this environment.
- 12.3 Air transport should be considered for longer journeys, where road access is difficult or when, for other reasons, it may be quicker. Perceived speed of air transport must be balanced against organisational delays and inter-vehicle transfers at either end of the journey.
- 12.4 Helicopters vary in size, capacity and range. They generally provide a less comfortable, more cramped environment than a road ambulance or pressurised fixed wing aircraft. In addition, they are expensive and have a poorer safety record. Due to their expense, they are not usually available to return staff and equipment to the base hospital and alternative arrangements have to be made.
- 12.5 Fixed wing aircraft, preferably pressurised, should be considered for transfer distances greater than 150 miles.
- 12.6 Arrangements should be discussed with local ambulance control or air carriers specialising in medical transfers. Contact numbers should be available in all ICUs and A&E departments.

13 PREPARATION FOR TRANSPORT

- 13.1 Prior to departure, transport attendants who have not been involved in the initial care of the patient should familiarise themselves with the treatment already undertaken and independently assess the patient's condition.
- 13.2 In all cases full clinical details including medical, family and social history must be obtained and a full clinical assessment including a physical examination performed. Recent investigations including haematology and biochemistry results, X-rays and scans should be reviewed. The patient's identity bracelet should be checked and verified against any cross-match forms and blood products likely to be required during the journey.
- 13.3 Meticulous resuscitation and stabilisation of the patient before transport is the key to avoiding complications during the journey¹⁷⁻¹⁹. Advice on pre-transfer care and stabilisation may be obtained (where appropriate) from the receiving hospital or regional transport team.

- 13.4 The airway should be assessed and if necessary secured and protected. Tracheal intubation and ventilation prior to transport are mandatory if there are any concerns about the integrity of the airway or the adequacy of ventilation.
- 13.5 Intubated patients should normally be paralysed, sedated and mechanically ventilated. Inspired oxygen may be guided by arterial oxygen saturation (SaO₂) and ventilation by end tidal carbon dioxide (EtCO₂). Following stabilisation on the transport ventilator, at least one arterial blood gas analysis should be performed prior to departure to ensure adequate gas exchange. Inspired gases should be humidified using a disposable heat and moisture exchanging filter (HME).
- 13.6 If a pneumothorax is present or likely, chest drains should be inserted prior to departure. Underwater seals should normally be replaced by leaflet valve (Heimlich type) drainage systems. Chest drains should **not** be clamped.
- 13.7 Secure venous access is mandatory and at least two wide bore intravenous cannulae (central or peripheral) are required. A suitably secured indwelling arterial cannula is ideal for blood pressure monitoring.
- 13.8 Hypovolaemic patients tolerate moving poorly and circulating volume should be near normal prior to transport^{F2}. This may require volume loading with crystalloid, colloid or blood, guided by central venous or pulmonary artery occlusion pressure monitoring and cardiac output measurement. If inotropes or other vasoactive agents are required to optimise haemodynamic status, patients should be stabilised on these before leaving the referring unit.
- 13.9 Patients who are persistently hypotensive despite resuscitation efforts should not be moved until stable. Continuing sources of blood loss or sepsis should be identified and controlled. Long bone fractures should be splinted to provide pain relief, cardiovascular stability and neurovascular protection.
- 13.10 A naso- or orogastric tube and urinary catheter should be passed and free drainage allowed into collection bags.
- 13.11 Conscious patients should be kept informed of the transfer and all other relevant information. Relatives should similarly be kept informed of travel arrangements but should not normally travel with the patient.
- 13.12 Before departure, named medical and nursing personnel at the receiving unit should be contacted to confirm the availability of the bed, update them on the patient's condition and provide an estimated time of arrival.
- 13.13 The means of return to base hospital for the medical and nursing staff accompanying the patient should be established.
- 13.14 Pre-departure check lists may help to ensure that all necessary preparations have been completed (Appendix 3 and 4).

^{F2} Aggressive fluid resuscitation may be harmful in patients with penetrating trauma or acute abdominal aortic aneurysm.

14 MONITORING DURING TRANSPORT

- 14.1 The standard of care and monitoring during transport should be at least as good as that at the referring hospital or base unit²⁰. The **minimum** standards required for all patients are:
- Continuous presence of appropriately trained staff
 - ECG
 - Non-invasive blood pressure
 - Arterial oxygen saturation (SaO₂)
 - End tidal carbon dioxide (EtCO₂) in ventilated patients
 - Temperature (preferably core and peripheral).
- 14.2 Intermittent non-invasive blood pressure measurement is sensitive to motion artefact and is unreliable in a moving vehicle. It is also a significant drain on the battery supply of monitors. Continuous, invasive blood pressure measurement, through an indwelling arterial cannula should normally be used²¹.
- 14.3 Central venous catheterisation is not essential but may be of value in optimising filling status prior to transfer. Central venous access is required for the administration of inotropes and vasopressors.
- 14.4 Measurement of pulmonary artery occlusion pressure and cardiac output by thermal dilution is impractical during transfer. Where pulmonary artery catheters are *in situ*, the pulmonary artery pressure trace should be continuously displayed on the transport monitor. If this is not possible, the catheter should not be left in the pulmonary artery during transport, but withdrawn to the right atrium or superior vena cava for central venous pressure (CVP) monitoring.
- 14.5 Intracranial pressure monitoring may be required in selected patients.
- 14.6 In mechanically ventilated patients the oxygen supply, inspired oxygen concentration (FIO₂) ventilator settings and airway pressure should be monitored.
- 14.7 A written record of patient status, monitored values, treatment given and any other clinically relevant information should be completed during the transfer.

15 MANAGEMENT DURING TRANSPORT

- 15.1 Patients should be laid on and wrapped in insulating cellular blankets or bubble wrap and then covered with blankets or a duvet to reduce heat loss. They should be adequately strapped to the trolley, preferably by means of a five point harness.
- 15.2 All equipment must be securely stowed. This should be either fastened to the transport trolley or securely stored in appropriate lockers in the ambulance. When this is not possible, equipment should be placed on the floor against the bulkhead wall. Under **no circumstances** should equipment (e.g. infusion pump) be left on top of the patient. This may become a dangerous projectile in the event of a sudden deceleration. Gas cylinders must be held in secure housings at all times.
- 15.3 Monitoring must be continuous throughout the transfer. All monitors and syringe drivers should be visible to accompanying staff.

- 15.4 Adequately resuscitated and stabilised patients should not normally require any dramatic changes to treatment during transport.
- 15.5 A major issue relating to safety during transport is the speed of travel. For the majority of cases high speed travel is not necessary and the safety of all passengers and other road users should be the overriding concern. The most senior medical attendant present may offer advice as to the patient's clinical condition and urgency that may affect the speed of travel and they should understand the requirements of the Road Traffic Act in this respect^{F3,F4}. The decision to use blue lights and sirens rests with the ambulance driver.
- 15.6 Staff should remain seated at all times and wear the seat belts provided. If, despite meticulous preparation, unforeseen clinical emergencies arise and the patient requires intervention, this should not be attempted in a moving ambulance. The vehicle should be stopped appropriately in a safe place and the patient attended to. Where staff may be required to move outside the vehicle high visibility clothing must be worn. On safety issues all staff in the vehicle must obey the instructions of the crew.

16 AEROMEDICAL CONSIDERATIONS

- 16.1 The transport of patients by air presents medical escorts with many problems unique to this mode of travel. Staff involved in aeromedical transport must have both a high level of expertise, specialist knowledge and practical training. Staff without appropriate training should not undertake aeromedical transfers. Minimum requirements include safety training, evacuation procedures for the aircraft and basic on board communication skills (particularly for helicopters). More advanced training in aeromedical transport medicine is however desirable.
- 16.2 Training should also address the special physical, physiological and psychological stresses that are important when flying as well as provide a detailed knowledge of how medical conditions can be affected by this environment and the necessary precautions needed to facilitate safe transfer.
- 16.3 Either helicopters or fixed wing aircraft may be used. Each type of aircraft is associated with specific problems, but these can be summarised as follows.
- 16.4 A fall in barometric pressure results in reduced alveolar partial pressure of oxygen and may lead to hypoxaemia. Increased inspired oxygen concentration is mandatory for all aeromedical transfers.
- 16.5 A fall in barometric pressure also leads to an increase in the volume of gas filled cavities in the patient. Pneumothoraces must be drained. Nasogastric tubes should be inserted and placed on free drainage. Pneumo-peritoneum and intracranial air are relative contraindications to air transport. Tissues may also swell and plaster casts should be split.

^{F3} Road Traffic Regulation Act 1984 permits a vehicle that is used for ambulance purposes to exceed the speed limits provided that the observance of speed limits would hinder the use to which that vehicle is being put on that occasion. *This is clearly not a blanket exemption but each case must be judged on merit.*

^{F4} The Traffic Signs Regulation and General Directions 1994, Pelican Crossing Regulations and General Directions 1987, allow emergency vehicles including ambulances to vary the requirements of certain signs including traffic lights and pelican crossings provided that the vehicle does not proceed at any time in a manner or at such a time as is likely to cause danger to pedestrians or other vehicles.

- 16.6 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. Portable warm air blanket systems (battery powered) may be used.
- 16.7 Noise and vibration may cause nausea, pain and motor dysfunction. Anti-emetic pre-medication should be available for patients and staff. Ear protectors should be worn. Intercom headphones should be used for essential communication and a working knowledge of 'radio' etiquette and verbal and non-verbal communication is essential.
- 16.8 Visibility may be limited and may hamper observation of both the patient and monitor. Visual alarms may be obscured and, when combined with the inability to monitor auditory alarms due to the high ambient noise levels, the consequences may be disastrous.

17 HANDOVER TO RECEIVING HOSPITAL

- 17.1 On arrival at the receiving hospital, there should be a formal handover between the transport team and the receiving medical and nursing staff who will assume responsibility for the patient's care.
- 17.2 Handover should include a verbal and written account of the patient's history, vital signs, therapy and significant clinical events during transport. X-rays, scans and other investigation results should be described and handed over to receiving staff.

18 DOCUMENTATION

- 18.1 Clear records should be maintained of all stages. These should include details of the patient's condition, reason for transfer, names of referring and accepting consultants, clinical status prior to transfer and details of vital signs, clinical events and therapy given during transport.
- 18.2 Standard documentation should be developed across networks and should be used for both intra-hospital and inter-hospital transport. This should include a core data set for audit purposes and the transport team should be able to retain a duplicate for such purposes. Suggested headings for inclusion in transport documentation are given in Appendix 5.

19 QUALITY ASSURANCE

- 19.1 Critical Care Networks are required to develop quality assurance programmes to ensure that adequate standards for the transfer of critically ill patients are maintained. This will include the development of audit tools and critical incident reporting and will require regular meetings to review the overall numbers of transfers, justification, clinical standards and outcome.
- 19.2 Procedures should be in place to enable the immediate notification of major critical incidents to other members of the Critical Care Network. The development of a national framework for communication between networks and the establishment of a national database of transfers of critically ill patients will support this.

- 19.3 The clinician in each hospital responsible for the organisation of hospital transport teams should ensure that all movements of critically ill patients within the hospital are subject to similar audit and critical incident reporting.

20 EDUCATION AND TRAINING

- 20.1 Personnel involved in the transport of critically ill patients have a responsibility to ensure that they are adequately trained and experienced.
- 20.2 Courses for the transport of critically ill patients are now available. These provide a background level of knowledge and are a useful adjunct to appropriate clinical training and experience including supervised transfers.
- 20.3 Competency based training and assessment should be developed to ensure the highest possible standards of care for the critically ill patient requiring transport. This should encompass not just medical staff but all members of the multidisciplinary team who may be potentially involved. The same level of training should generally be required whether transporting critically ill patients between departments within a hospital or between hospitals.

21 INSURANCE AND INDEMNITY

- 21.1 While safety is of paramount importance during transfer, there is always a remote possibility of an ambulance being involved in an accident resulting in death or serious injury to staff.
- 21.2 The insurance situation in these circumstances is complex. It is essential that all members of staff who might be involved in transporting patients ensure that adequate financial arrangements are in place for themselves and their dependants in the event of an accident.
- 21.3 The Intensive Care Society has negotiated insurance for all its members involved in the transport of critically ill patients. Details of this are available from the Society's offices. The key points are as follows:
- Cover for all members regardless of membership category
 - Cover from leaving home to return if called in to undertake a transfer
 - Cover anywhere in the world
 - Cover for any form of transport by road or air ambulance (helicopter or fixed wing)
 - Cover for death or severe disability resulting in the member being unable to resume normal occupation.

22 REFERENCES

1. Intensive Care Society. Guidelines for transport of the critically ill adult. London: Intensive Care Society, 1997.
2. Department of Health. Comprehensive Critical Care. A review of adult critical care services. London: Department of Health, 2000.
3. Committee of the American College of Critical Care Medicine. Guidelines for the transfer of critically ill patients. *Crit Care Med* 1993; 21: 931–7.
4. Australian and New Zealand College of Anaesthetists and Australian College of Emergency Medicine. Minimum standards for the transport of critically ill patients (revised ed). Australian College of Emergency Medicine, 1996.
5. Australian and New Zealand College of Anaesthetists and Faculty of Intensive Care. Intra-hospital transport of critically ill patients. Australian and New Zealand College of Anaesthetists, 2000.
6. The Neuroanaesthesia Society of Great Britain and Ireland and The Association of Anaesthetists of Great Britain and Ireland. Recommendations for the transfer of patients with acute head injuries to neurosurgical units. London: The Association of Anaesthetists of Great Britain and Ireland, 1996.
7. Paediatric Intensive Care Society. Standards for paediatric intensive care, including standards of practice for the transport of the critically ill child. Bishop's Stortford: Saldatore Ltd, 1996.
8. Mackenzie PA, Smith EA, Wallace PGM. Transfer of adults between intensive care units in the UK. *BMJ* 1997; 314: 1455–6.
9. Ridley SA, Carter R. The effects of secondary transport on critically ill patients. *Anaesthesia* 1989; 44: 822–7.
10. McGinn GH, Mackenzie RF, Donnelly JA, Smith EA, Runcie CJ. Inter-hospital transfer of the critically ill trauma patient: the potential role of a specialist transport team in a trauma system. *J Accident Emerg Med* 1996; 13: 90–2.
11. Vyvyan HAL, Kee S, Bristow A. A survey of secondary transfers of head injured patients in the south of England. *Anaesthesia* 1991; 4: 728–31.
12. Bellingan G, Olivier T, Batson S, Webb A. Comparison of a specialist retrieval team with current United Kingdom practice for the transport of critically ill patients. *Intensive Care Med* 2000; 26: 740–4.
13. Bion JF, Wilson IH, Taylor PA. Transporting critically ill patients by ambulance: audit by sickness scoring. *BMJ* 1988; 296: 170–1.
14. Gentleman D. Causes and effects of systemic complications among severely head injured patients transferred to a neurosurgical unit. *Int Surgery* 1992; 77: 297–302.
15. Department of Health. Guidelines on admission to and discharge from intensive care and high dependency units. London: Department of Health, 1996.
16. Smith IRA, Fleming S, Cernaianu A. Mishaps during transport from the intensive care unit. *Crit Care Med* 1990; 18: 278–81.
17. Runcie CJ, Reeve W, Reidy J, Wallace PGM. Secondary transport of the critically ill adult. *Clin Intensive Care* 1991; 2: 217–25.
18. Runcie CJ, Reeve WR, Wallace PGM. Preparation of the critically ill patient for inter-hospital transfer. *Anaesthesia* 1992; 47: 327–31.
19. Runcie CJ. Resuscitation, stabilisation and preparation for transport In: Morton NF, Pollack MM, Wallace PGM (Eds). *Stabilisation and Transport of the Critically Ill*. London: Churchill Davidson, 1997.
20. Association of Anaesthetists of Great Britain and Ireland. Recommendations for standards of monitoring (3rd ed). London: Association of Anaesthetists of Great Britain and Ireland, 2000.
21. Runcie CJ, Reeve WG, Reidy J, Dougall JR. Blood pressure measurement during transport. *Anaesthesia* 1990; 45: 659–65.

Appendix 1

SUPPLEMENTARY EQUIPMENT FOR USE DURING TRANSPORT

Airway

- Guedel airways (assorted sizes)
- Laryngeal masks (assorted sizes)
- Tracheal tubes (assorted sizes)
- Laryngoscopes (spare bulbs and battery)
- Intubating stylet
- Lubricating gel
- Magill's forceps
- Tape for securing tracheal tube
- Sterile scissors
- Stethoscope

Ventilation

- Self inflating bag and mask with oxygen reservoir and tubing
- High flow breathing circuit
- Spare valves for portable ventilator
- Chest drains (assorted sizes)
- Heimlich flutter valves

Suction

- Yankauer sucker
- Suction catheters (assorted sizes)
- Nasogastric tubes (assorted sizes) and drainage bag

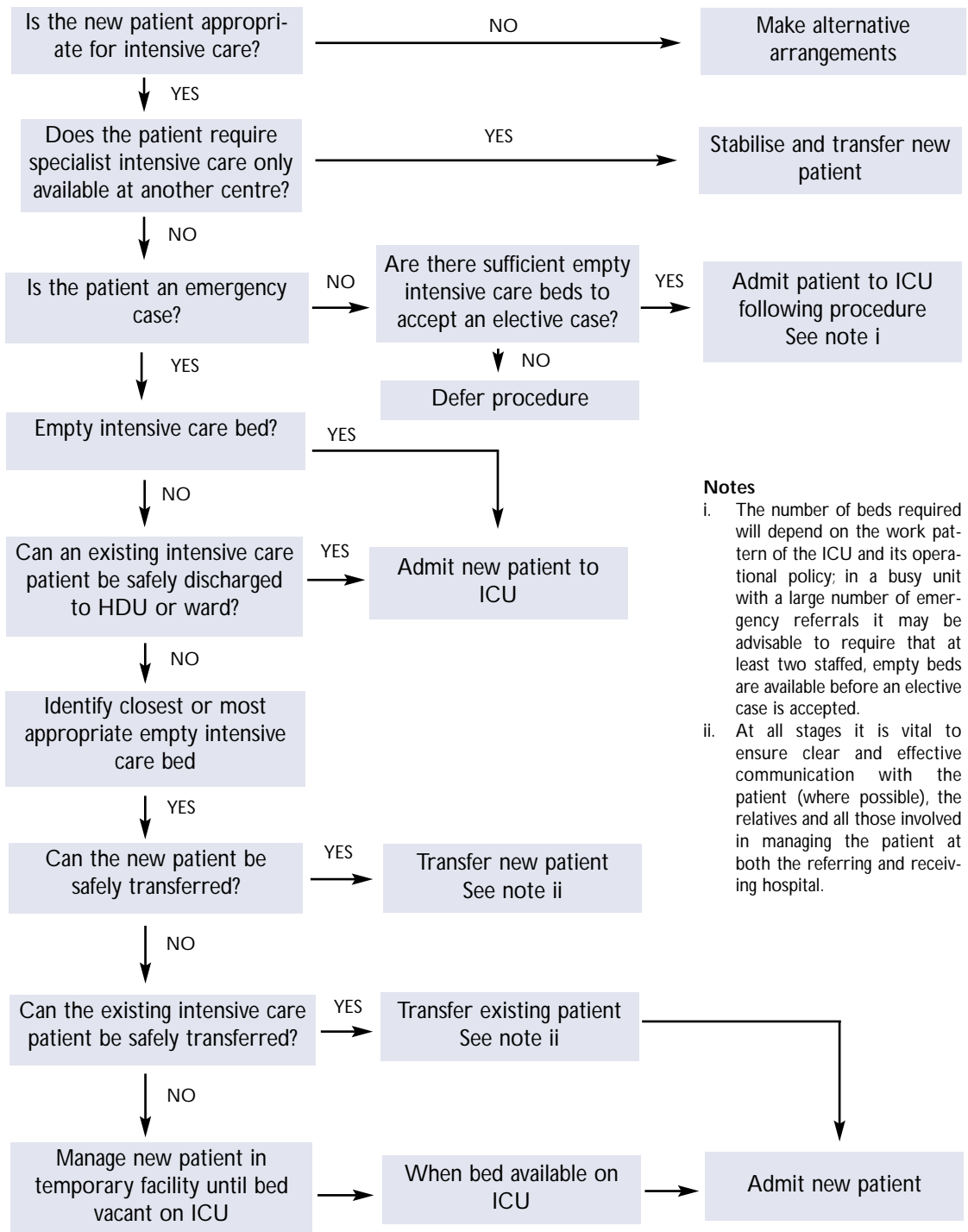
Circulation

- Syringes (assorted sizes)
- Needles (assorted sizes)
- Alcohol wipes
- IV cannulae (assorted sizes)
- Arterial cannulae (assorted sizes)
- Central venous cannulae
- Intravenous fluids
- Infusion sets/extensions
- 3 way taps
- Dressings
- Tape
- Minor instrument/cut down set

Appendix 2

GUIDELINES ON ADMISSION TO AND DISCHARGE FROM INTENSIVE CARE

Guidelines on admission to and discharge from intensive care and high dependency units, Department of Health 1996.



- Notes**
- i. The number of beds required will depend on the work pattern of the ICU and its operational policy; in a busy unit with a large number of emergency referrals it may be advisable to require that at least two staffed, empty beds are available before an elective case is accepted.
 - ii. At all stages it is vital to ensure clear and effective communication with the patient (where possible), the relatives and all those involved in managing the patient at both the referring and receiving hospital.

Appendix 3

CHECK LIST 1. IS THE PATIENT STABLE FOR TRANSPORT?

Airway

- Airway safe or secured by intubation
- Tracheal tube position confirmed on chest X-ray

Ventilation

- Paralysed, sedated and ventilated
- Ventilation established on transport ventilator
- Adequate gas exchange confirmed by arterial blood gas

Circulation

- Heart rate, BP stable
- Tissue and organ perfusion adequate
- Any obvious blood loss controlled
- Circulating blood volume restored
- Haemoglobin adequate
- Minimum of two routes of venous access
- Arterial line and central venous access if appropriate

Neurology

- Seizures controlled, metabolic causes excluded
- Raised intracranial pressure appropriately managed

Trauma

- Cervical spine protected
- Pneumothoraces drained
- Intra-thoracic and intra-abdominal bleeding controlled
- Intra-abdominal injuries adequately investigated and appropriately managed
- Long bone/pelvic fractures stabilised

Metabolic

- Blood glucose > 4 mmol/L
- Potassium < 6 mmol/L
- Ionised calcium > 1 mmol/L
- Acid-base balance acceptable
- Temperature maintained

Monitoring

- ECG
- Blood pressure
- Oxygen saturation
- End tidal carbon dioxide
- Temperature

Appendix 4

CHECK LIST 2. ARE YOU READY FOR DEPARTURE?

Patient

- Stable on transport trolley
- Appropriately monitored
- All infusions running and lines adequately secured
- Adequately sedated and paralysed
- Adequately secured to trolley
- Adequately wrapped to prevent heat loss

Staff

- Adequately trained and experienced
- Received appropriate handover
- Adequately clothed and insured

Equipment

- Appropriately equipped ambulance
- Appropriate equipment and drugs
- Batteries checked (spare batteries available)
- Sufficient oxygen supplies
- Portable phone charged and available
- Money/credit cards for emergencies

Organisation

- Case notes, X-rays, results, blood collected
- Transfer documentation prepared
- Location of bed and receiving doctor known
- Receiving unit advised of departure time and estimated time of arrival
- Telephone numbers of referring and receiving units available
- Relatives informed
- Return travel arrangements in place
- Ambulance crew briefed
- Police escort arranged if appropriate

Departure

- Patient trolley secured
- Electrical equipment plugged into ambulance power supply where available
- Ventilator transferred to ambulance oxygen supply
- All equipment safely mounted or stowed
- Staff seated and wearing seat belts

Appendix 5

TRANSPORT DOCUMENTATION

The following information should be recorded on transport documentation.

Transfer details

- Patient's name, address, date of birth
- Next of kin, what information they have been given and by whom
- Referring hospital, ward/unit, and contact telephone number
- Name of referring doctor and contact telephone number
- Receiving hospital, ward/unit and contact telephone number
- Name of receiving doctor and contact telephone number
- Names and status of the escorting personnel

A medical summary

- Primary reason for admission to the referring unit
- History and past history
- Dates of operations and procedures
- Number of days on intensive care
- Intubation history, ventilatory support and blood gases
- Cardiovascular status including inotrope and vasopressor requirements
- Other medication and fluids
- Type of lines inserted and dates of insertion
- Recent results and MRSA status

A nursing summary

- Nursing care required with reference to the following
- Respiration, cardiovascular parameters, communication methods, nutrition, pain and sedation, sleep patterns, elimination, skin condition, hygiene and social needs

Patient status during transfer

- Vital signs including ECG, blood pressure SaO₂, EtCO₂, temperature, respiratory rate, peak inspiratory pressure, PEEP
- Drugs given during transfer including infusions
- Fluids given during transfer
- Summary of patient's condition during transfer signed by escorting doctor

Audit data including:

- Reason for the transfer
- Whether the transfer was within or outside the local network
- The urgency of the transfer
- Time taken for transfer from time of ambulance request to completion
- Adverse events/critical incidents

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