



Recommendations for the Transfer of Patients with Acute Head Injuries to Neurosurgical Units

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SECTION I - SUMMARY AND RECOMMENDATIONS

1. There should be a designated consultant in the referring hospital with overall responsibility for the transfer of patients with head injuries to the neurosurgical unit* and one at the neurosurgical unit with overall responsibility for receiving the transfers.
2. Local guidelines on the transfer of patients with head injuries should be drawn up between the referring hospital trusts and the neurosurgical unit which should be consistent with established national guidelines. Details of the transfer of the responsibility for patient care should also be agreed.
3. Thorough resuscitation and stabilisation of the patient must be completed before transfer to avoid complications during the journey. A patient persistently hypotensive, despite resuscitation, must not be transported until all possible causes of the hypotension have been identified and the patient stabilised.
4. Only in exceptional circumstances should a patient with a significantly altered conscious level requiring transfer for neurosurgical care not be intubated.
5. Patients with head injuries should be accompanied by a doctor with at least two years experience in an appropriate specialty (usually anaesthesia). Ideally, they should be on a Specialist Register. They should be familiar with the pathophysiology of head injury, the drugs and equipment they will use, working in the confines of an ambulance (or helicopter if appropriate) and have received supervised training in the transfer of patients with head injuries. They must have an adequately trained assistant. They must be provided with appropriate clothing for the transfer, medical indemnity and personal insurance.
6. The transfer team must be provided with a means of communication with their base hospital and the neurosurgical unit during the transfer - a portable 'phone may be suitable.

* Throughout this document the term neurosurgical unit is taken to include the departments of neurosurgery and neuroanaesthesia, and the neuro-intensive care unit

7. Education, training and audit are crucial to improving standards of transfer; appropriate time and funding should be provided.

SECTION II - INTRODUCTION AND BACKGROUND

Trauma services are organised on a district basis, but neurosurgical services are organised regionally in the United Kingdom. As a result, many patients with serious head injuries have to be transferred between hospitals by road ambulance, or occasionally by air. This pattern of services is likely to persist for the foreseeable future.

There is now ample evidence that interhospital transfer is potentially hazardous, is often poorly managed, patients can come to harm as a result and that this can be avoided if sound principles are applied in practice. The main causes of secondary brain damage are hypoxia, hypercarbia and cardiovascular instability.

These recommendations are aimed at helping those who bear professional responsibility for ensuring the safety of patients with serious head injuries during transfer between hospitals. Anaesthetists are prominent among these professionals.

SECTION III - ORGANISATION AND COMMUNICATION

Safe transfer of patients with head injuries requires an effective and constructive partnership between the referring hospitals, the neurosurgical unit and the ambulance service.

It is important to agree certain local guidelines between the referring hospitals and the neurosurgical unit in advance. Examples include: which patients should be referred, when a transfer should be made, the preparations and arrangements for the journey itself so that there is no unnecessary delay and when the responsibility for the patient is transferred from the receiving hospital doctors to the neurosurgeons. Anaesthetists should be involved in agreeing local guidelines which should be consistent with established national guidelines. Guidelines do not replace clinical judgement but they provide a safe framework within which judgement can be exercised.

Every hospital to which the ambulance services take patients with serious head injuries must have full facilities for resuscitation and appropriate staff and equipment to ensure a safe journey to the neurosurgical unit. There should be a designated consultant within that NHS Trust who has overall responsibility for secondary transfers. There should be a designated consultant at the neurosurgical unit who has overall responsibility for receiving the transfers.

Education and training are crucial to improving standards of transfer. Appropriate resources must be provided by those who plan and purchase these services. They must be available to all professionals who share responsibility for the safety of the patient. There are obvious advantages in having a common philosophy of care and standardised terminology, such as are provided by the Advanced Trauma Life Support (ATLS) system and the Glasgow Coma Scale (GCS).

Good verbal and written communications are vital. This is especially so at the time of referral and when a patient is handed over at the end of the transfer.

SECTION IV - STAFFING REQUIREMENTS AND STANDARDS

It is essential that expediency does not dictate the level of expertise available for the transfer of patients.

Patients with acute head injuries must be accompanied by an anaesthetist, or other doctor, with suitable training, skills and experience of head injury transfer if:

- **their Glasgow Coma Scale is deteriorating,**
- **they are intubated,**
- **they are undergoing therapy to reduce intracranial pressure,**
- **they are receiving cardiovascular support.**

Every accompanying doctor should have at least two years training in an appropriate specialty and be trained in the transfer of patients with head injuries. Ideally the accompanying doctor should be on an appropriate specialist register. **It must be recognised that a trainee sent alone in an ambulance is working in an unsupervised capacity** . As with any procedure all trainees should be directly supervised until deemed competent. Current changes in training may reduce the availability of trainees for transfers. **Thus, consultant time for transfers must be built into manpower projections.**

A trained assistant must be provided for the escorting doctor. This might be an operating department assistant/practitioner (ODA/ODP), a nurse trained in neurological critical care or an appropriately trained paramedic.

Escorting doctors must be sure that their medical indemnity insurance is appropriate for such journeys; membership of one of the defence societies is deemed essential. Adequate death and injury insurance must be provided for the members of the transfer team; NHS Trust insurance may be woefully inadequate. Details of appropriate insurance schemes are available from the Association of Anaesthetists.

SECTION V - PREPARATION FOR THE TRANSFER

The decision to transfer a patient with a head injury must be made by the medical staff of the referring hospital in consultation with the staff of the neurosurgical unit, who should provide advice on neurosurgical management such as the use of mannitol or anticonvulsants

Thorough resuscitation and stabilisation of the patient before transfer is the key to avoiding complications during the journey.

The fundamental requirement before transfer is to ensure satisfactory and stable perfusion and tissue oxygen delivery.

Resuscitation and assessment is the first priority and must be completed before the transfer commences. This will require:

Airway, Breathing, Circulation and ATLS primary survey

Life saving intervention

Monitoring:

ECG

pulse oximetry

invasive blood pressure

urine output by urinary catheter

capnography

central venous pressure monitoring where indicated

Investigation including:

chest, lateral cervical spine, pelvis and other appropriate X-rays

haematology

biochemistry

ECG

blood gas estimation

peritoneal lavage, if there is a suspicion of intra-abdominal bleeding

other investigations as appropriate (eg in cardiothoracic trauma).

Appropriate respiratory support must be established. During transit, intubating conditions are far from ideal and the possibility of the development of a compromised airway or respiratory failure merits intubation of the trachea before departure. **Only in exceptional circumstances should a patient with a significantly altered**

conscious level requiring transfer for neurosurgical care not be sedated, intubated and ventilated. Intubation requires adequate sedation and muscle relaxation to avoid an increase in intracranial pressure (ICP) and measures to prevent aspiration of gastric contents. When intubated, appropriate drugs should be employed to maintain sedation, analgesia and muscle relaxation, preferably administered by infusion by syringe pumps, but taking care to avoid hypotension and reduced cerebral perfusion pressure. Patients should be ventilated with the aim of achieving a PaO₂ greater than 13 kPa and a PaCO₂ of 4.0 - 4.5 kPa. Inspired oxygen may be guided by SpO₂ readings and by blood gas estimations before departure. If possible expired CO₂ should be monitored continuously. A chest drain should be inserted if a pneumothorax is present or possible from fractured ribs; a portable chest drain kit which is commercially available is convenient for transfers. A large bore orogastric tube (not nasogastric in case the patient has a base of skull fracture) should be passed.

Intravenous volume loading should be undertaken with crystalloid or colloid initially to maintain or restore satisfactory peripheral perfusion, blood pressure and urine output. Blood should be given if needed. Hypovolaemic patients tolerate transfer poorly and the circulating volume should be normal or supra-normal before transfer, preferably with a haematocrit over 30%. A central venous catheter may be useful to optimise filling pressures and for the administration of drugs and fluids during the transfer. **A patient persistently hypotensive despite resuscitation must not be transported until all possible causes of the hypotension have been identified and the patient stabilised. Correction of major haemorrhage takes precedence over transfer.** It is important that these measures are not omitted in an attempt to speed transfer of the patient, as resultant complications may be impossible to deal with once the journey has commenced.

Unstable or compound long bone fractures should have preliminary toilet and be splinted to provide neurovascular protection and analgesia.

All lines and tubes must be fixed securely and ready access to them ensured.

If the transfer team has not been involved in the initial stages they should familiarise themselves with treatment already given and independently

assess the general status of the patient before departure. The transfer team should confirm the availability of an appropriate transfer vehicle and check the function of all equipment, including battery charge status. Oxygen requirements for the journey including possible delays should be estimated. Before departure, case notes, X-rays, a referral letter and investigation reports should be collated and any required blood or blood products collected. The neurosurgical unit should be contacted and informed of the estimated time of arrival.

SECTION VI - THE TRANSFER

The transfer team should be relieved of all other duties, be appropriately dressed, equipped and insured.

Ideally, the transfer team should be involved in the initial resuscitation and management of the patient. If this is not possible, they should receive a formal hand over from the resuscitation team. All notes (or photocopies), X-rays, blood results and cross matched blood should accompany the patient. **The consultant in the referring Trust with responsibility for inter-hospital transfer or his named deputy should be made aware of the planned transfer.**

All monitoring equipment should be checked, connected to the patient and securely mounted so that it cannot fall on to the patient during transfer. The patient should be transferred on to the transport trolley/stretchers with due regard to the presence of a possible spinal injury, be properly secured and padded. The patient should be positioned with a 15° head up tilt if possible.

Most transfers will be by land ambulance but for transfers over longer distances consideration should be given to the use of appropriate helicopter services. This will require doctors and managers to agree locally on protocols for the use of helicopters which will include telephone numbers of recognised schemes. Doctors should be able to implement these protocols without referral to hospital managers.

During transfer, patient management will be centred upon maintaining oxygenation and adequate blood pressure. Monitoring ECG, invasive blood pressure, SpO₂ and PECO₂, and the administration of drugs and other infusions should be continued. **Although it is difficult to write in a moving ambulance, a record must be maintained during the transfer, either on paper, on dictaphone or by electronic memory in monitors.** Transfers should be undertaken smoothly and not at high speed. The transfer team should be equipped with a method (eg a portable telephone pre-programmed with useful numbers, and a back-up written list) of contacting the neurosurgical unit and their base hospital en route. The need to perform any procedure during the transfer probably indicates inadequate preparation for the transfer and should be avoided if possible. If required this should be done with the ambulance brought to a halt.

A patient who has been made physiologically stable before departure is more likely to remain so for the duration of the transfer. This does not avoid the need for constant vigilance and prompt action to deal with complications.

Staff at the neurosurgical unit should be ready to assist with the unloading of the patient, who should be taken directly to the receiving area where the transfer team will hand over to the staff of the neurosurgical unit. Ventilation and monitoring will be established on the neurosurgical unit equipment and the patient reassessed. Notes, X-rays, scans and a copy of the transfer record should be left with the receiving staff.

The neurosurgical unit should be prepared to provide the transfer team with refreshments and accommodation if required. A protocol should be established to return the team with their equipment to their hospital as quickly as possible.

The transfer team should keep a copy of the summary and transfer record for audit purposes and should be encouraged to follow up the patient by telephone. The importance of direct telephone lines, fax capabilities and photocopying in all relevant areas must be emphasised.

The relatives should be notified about the transfer by the referring hospital, but they should not normally accompany the patient in the ambulance.

In general, once the patient has arrived at the neurosurgical unit, a further acute inter-hospital transfer is clinically undesirable and should be exceptional. If, for specific reasons it is necessary, the patient must be reassessed and restabilised before leaving the neurosurgical unit, with appropriate monitoring and vigilance continued throughout any subsequent journey.

SECTION VII - EQUIPMENT AND DRUGS

All equipment must be serviced regularly and must be checked daily and before any transfer. If the ambulance ventilator is to be used then it must be checked before departure, as should the ambulance oxygen supply and suction. It is advisable before purchasing any new equipment to consult the ambulance service, to ensure that it is compatible with the oxygen and power supply in their vehicles.

The patient should receive the same standard of physiological monitoring during transfer as they would receive in an intensive care unit.

The transfer team must be familiar with all of the equipment and drugs in the transfer kit and the transfer vehicle.

Essential equipment to go with the patient in the ambulance

The following equipment should be readily available, purpose designed, dedicated for transfers and stored in a suitable container which should have some form of seal, which when broken, would indicate that the equipment has been used and requires to be restocked and checked:

- **portable mechanical ventilator** with airway pressure and minute volume monitor, and disconnect alarm
- **adequate supply of oxygen** for the journey, including unforeseen delays - consideration should be given to the use of small portable liquid oxygen containers
- **portable battery powered multifunction monitor** to include:
 - ECG
 - invasive blood pressure monitoring
 - non invasive blood pressure monitoring as a backup
 - central venous pressure monitoring
 - pulse oximetry
 - capnography
 - temperature
- **Other equipment**
 - suction
 - peripheral nerve stimulator

- battery powered syringe pumps
- battery powered IV volumetric pumps (infusion by gravity is unreliable during transfer)
- intubation equipment
- self inflating bag, valve and mask
- venous access equipment
- chest drain equipment
- urinary catheter
- semi rigid cervical collars
- DC defibrillator
- spare batteries
- warming blanket

Essential drugs to go with the patient

hypnotics	eg propofol or midazolam
muscle relaxants	eg atracurium, vecuronium, pancuronium suxamethonium may be required for re-intubation
analgesics	eg alfentanil, fentanyl, phenoperidine
anticonvulsants	eg diazepam, thiopentone
mannitol 20%	
vasoactive drugs	eg ephedrine, dopamine, dobutamine
resuscitation drugs	as in hospital resuscitation boxes

Communication equipment

It is essential that the transfer team should be able to communicate easily with the designated consultant or his deputy in the referring hospital and the neurosurgical team during the transfer. A portable telephone which can be pre-programmed with useful numbers is probably the most convenient despite the risk of it interfering with electronic equipment.

Paediatric equipment

The transfer of paediatric patients will require separate specific equipment.

SECTION VIII - EDUCATION AND TRAINING

Good practice depends upon sound education, adequate resources of expertise, time for training and a commitment to quality throughout all levels of the organisation. Ensuring and facilitating good educational standards and arrangements will be a function of the consultant responsible for inter-hospital transfers.

The fundamental requirement is that every doctor, nurse and paramedic likely to be involved in the transfer of seriously head injured patients has had formal training in the theoretical and practical aspects of the subject. This will include:

- the principles of managing a patient with an acute head injury;
- the principles and practice of Advanced Trauma Life Support;
- the adverse physiological changes associated with moving the patient;
- loading and unloading the patient;
- practical aspects of working in an ambulance or helicopter;
- knowledge of the equipment and drugs used in transfer;
- the legal and safety aspects of transfer;
- communications.

The setting in which this education is provided will vary locally. Learning opportunities will range from the induction courses for new senior house officers in accident and emergency departments to formal training courses on transfer medicine. The latter are now run in a limited number of centres, and may be particularly appropriate for consultants responsible for developing and maintaining the standards of transfer.

All doctors and staff from relevant specialties who are new to a hospital should attend teaching sessions to learn local arrangements and policies and meet the staff involved.

Much of the educational value of any training post comes from gaining clinical experience under supervision. The designated transfer consultant should be aware of the educational opportunities offered by transfers of patients with head injuries to the neurosurgical unit. It is important to involve as many as possible of those who take part in regular interdepartmental audit: A&E doctors and nurses, anaesthetists, paramedics, etc. Feedback from the neurosurgical unit is particularly valuable.

SECTION IX - RESOURCE IMPLICATIONS FOR TRANSFER OF PATIENTS WITH HEAD INJURIES

Without adequate resources it is not possible to have a good quality service. Each Trust should recognise that this requires specific funding which should be considered in discussions with purchasers. Resources involve staffing and equipment which may be similar to and shared with those used for other secondary transfers including the movement of ICU patients within the hospital.

Trusts involved in transfer of patients with head injuries should set aside a budget for this work. The budget will include the capital equipment, the cost of which will depend upon its complexity and the demand placed upon it, as well as the cost of servicing, maintenance and insurance. Portable equipment will need regular battery replacement and will have a shorter life than static equipment. There must be adequate provision for clothing and personal insurance.

Ambulance services may charge NHS Trusts for secondary transfers, and this should be considered when setting budgets. Additional monies may have to be set aside for secondary helicopter transfers.

The responsibilities of the consultant for secondary transfers includes clinical management, training, audit and liaison between the parties involved and **may require separate sessional commitment.**

Rotas of both doctors and nurses must take account of this work and allow staff of adequate seniority to be released from other duties.

APPENDIX 1

INDICATIONS FOR INTUBATION AND VENTILATION AFTER HEAD INJURY

IMMEDIATELY:

- Coma - not obeying commands, not speaking not eye opening. i.e. GCS 8
- Loss of protective laryngeal reflexes
- Ventilatory insufficiency as judged by blood gases
 - hypoxaemia ($\text{PaO}_2 < 9 \text{ kPa}$ on air or $< 13 \text{ kPa}$ on oxygen)
 - hypercarbia ($\text{PaCO}_2 > 6 \text{ kPa}$)
- Spontaneous hyperventilation causing $\text{PaCO}_2 < 3.5 \text{ kPa}$
- Respiratory arrhythmia

BEFORE THE START OF THE JOURNEY:

- Significantly deteriorating conscious level, even if not in coma
- Bilateral fractured mandible
- Copious bleeding into the mouth (eg from skull base fracture)
- Seizures

An intubated patient must be ventilated with muscle relaxation, and should receive sedation and analgesia

Aim for a $\text{PaO}_2 > 13 \text{ kPa}$, $\text{PaCO}_2 4.0 - 4.5 \text{ kPa}$

modified from Gentleman et al BMJ 1993; **307**: 547-552

APPENDIX 2

TRANSFER CHECKLIST FOR NEUROSURGICAL PATIENTS	
SYSTEM	CHECKLIST
Respiration	PaO ₂ > 13 kPa? PaCO ₂ < 4.5 kPa? Airway clear? Airway protected adequately? Intubation and ventilation required?
Circulation	BP systolic > 120 mmHg? Pulse < 100/min? Peripheral perfusion? 2 Reliable large iv cannula <i>in situ</i> ? Estimated blood loss already replaced?
Head injury	GCS? GCS trend? (improving/deteriorating) Focal signs? Skull fracture?
Other injuries	Cervical spine injury, chest injury, fractured ribs, pneumothorax excluded? Intrathoracic, intra-abdominal bleed? Pelvic, long bone fracture? Extracranial injuries splinted?
Escort	Doctor & nurse adequately experienced? Instructed about THIS case? Adequate equipment and drugs? Can use equipment and drugs? Case notes and X-rays? Where to go to in the neurounit? Telephone numbers programmed into portable phone? Portable phone battery fully charged? Name and bleep number of receiving doctor? Money in case of emergencies?

modified from Gentleman et al *Lancet* 1990; **335**: 330 - 334

FURTHER READING

Guidelines

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