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# Critical care in the emergency department: patient transfer

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The intrahospital and interhospital transfer of critically ill patients is an inevitable part of emergency department practice. Critically ill patients have a high risk of morbidity and mortality during transport. This article reviews current recommendations for the transfer of critically ill patients, with a particular focus on pre-transfer stabilisation, hazards during transport and the personnel, equipment and communications necessary throughout the transfer process.

Transfers can be primary or secondary. In the UK, primary transfers to hospital from a prehospital site of illness or injury are commonly the responsibility of the ambulance service. These systems may be supported or supplemented by doctors. Secondary transfers include both intrahospital and interhospital transport, and are inevitable for all critically ill patients in the emergency department unless they die during their time in the resuscitation room. Emergency departments may also receive interhospital critical care transfers as an intermediate destination.

The decision to transfer a patient to another hospital is made after an assessment of the potential risks and benefits to the patient. Indications for interhospital transfer include the need for specialist investigation or intervention, or ongoing support not provided in the referring hospital. Non-clinical reasons for transfer include the lack of an appropriately staffed critical care bed locally, or repatriation to a local hospital.[1] Interhospital transfers are often made out of normal working hours, and the patient may be accompanied by relatively junior staff, leading to a high rate of critical incidents. These transfers account for up to 30% of all interhospital critical care transport, and half of these are patients with trauma .[2] The need for standards and training in such transfers were emphasised >10 years ago.[3] This has been dealt with to some extent by the Safe Transfer and Retrieval course, but many trainees still lack training in the transfer of critically ill patients.

## CLINICAL SCENARIO

A 28-year-old man is admitted to the resuscitation room, having fallen 3 m. He had a brief period of loss of consciousness at the scene, but his Glasgow coma scale (GCS) score was 15 on arrival of the ambulance. During the primary transfer to hospital, he became increasingly confused. On examination, he is immobilised on a long spinal board with cervical spine collar, blocks and tape. He is maintaining and protecting his airway; he is breathing high-flow oxygen from a mask with a reservoir bag, his respiratory rate is 24 breaths/min, with no obvious chest injury, and pulse 98 beats/min. His blood pressure is 130/85 mm Hg, oxygen saturation is 98%. His GCS score is 13 (E3, M6 and V4), pupils are equal and reactive and there is no focal neurological abnormality on examination. He has a full-thickness laceration in the right temporal scalp and tenderness in the left upper quadrant of his abdomen. He has no obvious limb injuries. *x* Rays of his chest and pelvis are normal. In view of the mechanism of injury and neurological findings, the decision is made to carry out a computed tomographic scan of the patient's head, cervical spine and abdomen.

## QUESTION 1

What should be done before transferring the patient to the radiology department?

### Pre-transfer stabilisation and packaging

Pre-transfer assessment and optimisation to physiological normality before definitive care should be the ideal for all transfers, to ensure best outcomes.[4 5] However, emergency department transfers are a balance between achievability, the need for urgent transport and the accepting team's readiness. The nature and severity of the patient's condition, and the local or regional availability of transfer personnel and equipment influence this balance. It is also influenced by the availability of specialist investigations or interventions. Undertreated or neglected injuries can adversely affect outcome, as can the lack of anticipation of potential cardiovascular or respiratory problems.[6–12] For many patients, longer pre-transfer times will not adversely affect outcome[13 14] and pretransfer optimisation may be beneficial. However, delays may be harmful to certain groups (eg, patients with a ruptured abdominal aortic aneurysm or expanding intracranial haematoma).[15 16]

Before transfer for investigations, emergency department staff should begin appropriate measures to correct and stabilise physiological abnormalities. Unnecessary delays caused by transfer personnel carrying out further procedures should be avoided where possible.[17] Preparation for transfer and packaging should be thorough and complete before patient transfer. Guidelines for pre-transfer assessment and stabilisation have been published by the Intensive Care Society (ICS), the American College of Critical Care Medicine, the American College of Emergency Physicians, the Australasian College of Emergency Medicine, and the Faculty of Intensive Care of the Australian and New Zealand College of Anaesthetists.[4 18–21] Specific guidelines for the transport of the critically ill child have been published in the UK.[22] These

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**Abbreviations:** GCS, Glasgow coma scale; ICS, Intensive Care Society

**Table 1** Key to good pretransfer assessment and preparation

| | |
|---|---|
| Patient | Familiarisation with current condition, investigation results, current treatment and further management plan |
| Transfer staff | Suitably trained staff, appropriate clothing, adequate handover from referring team, return plans arranged and insurance |
| Equipment | Suitable equipment and drugs, spare batteries and sufficient oxygen |
| Organisation | Patient notes and investigation results, transfer documentation, coordination of transfer vehicle and personnel, relatives informed and compliance with relevant regulations |
| Destination | Receiving doctor name, receiving unit address and telephone number, and directions to receiving unit |
| Pre-departure | Receiving unit informed of estimated time of arrival, patient packaged and secured, equipment secured or stowed, electrical and oxygen supplies attached to vehicle outlets if appropriate, transfer staff seated and secured if appropriate |

guidelines follow a systematic approach to preparation (table 1).

The patient's resuscitation and stabilisation should follow an *****ABCDE approach.[1] If there are any concerns about the integrity of the airway or the adequacy of ventilation, the airway must be secured with a tracheal tube. For patients with trauma, spinal immobilisation must be maintained throughout the transfer unless a spinal injury has been reliably excluded. If chest decompression is required, an intercostal tube drain should be inserted. A Heimlich valve system may be used in preference to an underwater seal for certain transfers (eg, aeromedical and prolonged transfers). Intravenous access must be achieved with at least two reliable cannulae, of which one may be in a central vein if central venous pressure monitoring or centrally delivered drugs are required. Nasogastric or orogastric tubes should be inserted in patients with ileus or intestinal obstruction, or in those requiring mechanical ventilation. A urinary catheter should be inserted in patients requiring strict fluid management or in those with a longer duration of transport.

Irrespective of the type of transfer or mode of transport, the same standards of care should apply.[20 23–25] Finally, before departing, a final rapid assessment of the patient's ****ABCs should be made.

### Case progression

A computed tomographic scanner is available immediately, and is a few minutes' walk from the resuscitation room of the emergency department. The patient's spine is kept immobilised, but the long spinal board is removed. Supplemental oxygen is given via a facemask, and two peripheral intravenous cannulae are inserted. Intravenous fluid treatment is started. After computed tomography, the patient is arranged to return to the resuscitation room of the emergency department.

As the final check is made immediately before leaving the emergency department, the patient's neurological status deteriorates, with his GCS score falling to 7 (E2, M4 and V1). The patient undergoes rapid-sequence induction and tracheal intubation. Mechanical ventilation is started, and infusions of drugs are started to keep him sedated and paralysed. An arterial cannula is placed to monitor blood pressure and check arterial blood gases to ensure adequacy of ventilation; and an orogastric tube is inserted before transfer.

## QUESTION 2

Who should accompany the patient to the computed tomographic scanner?

### Transfer personnel

Ideally, the transfer of critically ill patients would be carried out by specially trained individuals. The American College of Critical Care recommends a minimum of two people to accompany each patient.[18] A doctor with training in airway management, advanced cardiac life support and experience in critical care should accompany all patients who are unstable. The recommendations of the ICS are similar; the doctor should be experienced and competent in transport medicine, and the other attendant should be a suitable nurse, paramedic or technician familiar with intensive care procedures.[4]

The composition of the team will depend on the diagnosis of the patient and also on the local availability of personnel. However, although there are recommended standards, these are often not met.[2] Evidence suggests that the quality of care during transfer can be enhanced if a specialist retrieval team is used.[26 27] A variety of theories have been proposed to account for the benefits, including better pretransfer stabilisation, formal transfer protocols, improved staff training and seniority, and equipment availability and appropriateness. In the UK, retrieval teams have been advocated by the Department of Health for interhospital transport,[28] but their cost effectiveness has not been proved in adults. Paediatric retrieval teams have been shown to be more effective and safer than standard care,[29 30] and are recommended by the Paediatric Intensive Care Society.[22]

Local and regional guidelines, systems and networks vary, and thus local knowledge of available resources should be mandatory for all emergency departments. As there will almost certainly be occasions when the existing resource for transfer is unavailable (eg, when the team is needed in two places at once), local and regional contingency plans should be made pre-emptively.[18]

### Case progression

Owing to the workload in theatre, an anaesthetist is not immediately available, and therefore an emergency department consultant, an emergency department nurse trained in critical care and a porter accompany the patient to the computed tomographic scanner and back to the emergency department. The patient's condition remains stable throughout the transfers and investigation. The computed tomographic scan of the brain shows a right extradural haematoma with minimal midline shift. His cervical spine and abdominal computed tomographic scans are normal. Neurosurgical services are based in a hospital 10 miles away.

## QUESTION 3

What changes to this patient's transfer process should now be made?

### Transport preparation and equipment

Decision making for patient transfer is a dynamic process. Anticipation of the probable course of events will guide pretransfer care, with the aim of minimising intervention during transport. Continual monitoring is essential for safe transfer. Ideally, the measurement of physiological parameters should be the same during transfer as it is in the resuscitation room. The ICS advises portable monitors with illuminated displays to show the electrocardiogram, arterial oxygen saturation, non-invasive blood pressure, quantitative end tidal carbon dioxide in ventilated patients and temperature as minimum recommended standards.[4] Continuous invasive blood pressure

monitoring should also be carried out, although this may not be necessary for short intrahospital transport in stable haemodynamically normal patients. Invasive pressure monitoring, including central venous pressure monitoring, may be necessary in certain patients. In mechanically ventilated patients, the oxygen supply, inspired oxygen concentration, ventilator settings and airway pressure should be monitored. These patients are best paralysed to allow easier control of ventilation and reduce the risk of inadvertent patient movement. Arterial blood gas should be analysed once the patient is established on the transfer ventilator before departure. The Association of Anaesthetists of Great Britain and Ireland have recently published recommendations which include specific haemodynamic and ventilatory targets.[31]

Monitors should use both visual and audible alarm systems. The ventilator should have disconnection and high airway pressure alarms. A defibrillator should also accompany every patient.[4 18 21]

Syringe or infusion pumps should be used to enable the delivery of all intravenous fluids and drugs, as gravity-fed drips may be unreliable when moving. If possible, these pumps should be below the level of the patient and be fitted with antisiphon devices. All electrical equipment must be able to function from a battery source when not plugged into the mains and spare batteries should be available in case of power failure. The anticipated duration of battery life and duration of transport should allow adequate planning so that equipment power failure is avoided. During transport, the oxygen and electricity supplies of the transfer vehicle should be used in preference to small, portable oxygen cylinders and battery power.

Equipment for advanced airway management, appropriately sized for the patient, should be carried, as should basic resuscitation drugs. Supplemental drugs for sedation, analgesia and paralysis should be considered on an individual patient basis, as should vasopressers, ionotropes and antiarrhythmics. Ample intravenous fluids with administration sets and replacement intravenous cannulae should also be carried. Equipment for airway suctioning should be carried or available at all times during transport. A device to manually ventilate the patient must be available whenever a mechanical ventilator is used during transfer.

The patient transport trolley should be designed to securely carry monitors, a ventilator, syringe drivers or infusion pumps and reserve oxygen, and be compatible with the trolley mounting system in the transfer vehicle. If possible, most equipment should be mounted at or below the level of the patient to allow unhindered access to the patient. Cable tidies may help prevent tangling of wires. Vehicles for critical care transport in the UK are often standard land ambulances.[1] However, specially adapted ambulances can offer a preferred layout, augmented gas and power supplies, and permanent storage of equipment. Specific standards are set for air ambulances stipulated by the Civil Aviation Authority in the UK.

The transfer team also needs to be appropriately equipped. The benefits of a mobile phone, programmed with essential numbers for the transfer outweigh the potential risk of interference with medical equipment. Money should also be taken in case refreshments are required after a prolonged journey and for the occasional need to return to base by taxi.

### Communication

Good communication between all parties is essential. Before transport, communication between referring and receiving teams should include patient condition, investigation and treatment plans, method and timing of transfer, agreed destination, and importantly, the acceptance of admission to the receiving unit. Ideally, this communication is reiterated immediately before transport to update the teams of any developments in the patient's condition or in the transfer arrangements and timing. If practical, a further communication with the receiving unit is made during the transfer to give an update and an estimated time of arrival.[1 18]

The responsibility for care of the patient is with the transport team until a formal handover from medical and nursing staff has been completed. This handover will include patient-specific information and plans, but also any problem incurred during transport and the status of relatives or next of kin.

In addition to oral communication, written documentation is a necessary part of patient transfer. Various organisations have produced suggested pretransfer checklists and transfer documents. These are useful as aide memoire, but also as a record for clinical governance purposes. Copies of patient notes, investigation results and physiology records should be transported with the patient along with written details of the transfer, including name of the receiving doctor and contact number, destination address and contact number, and directions if necessary. Where blood has been cross matched at the referring hospital, only sufficient units to meet the expected needs en route should accompany the patient. Lab-to-lab transportation of further blood will prevent wastage of units whose continued refrigeration since issue cannot be guaranteed.

The coordination of transfer vehicles and personnel for interhospital transport needs good communication between referring units, transport teams if used and the service supplying the vehicle, most often an ambulance service. This coordination often occurs through a central bureau, although local policies may vary. Arrangements should be made for the transport of patients and personnel to the receiving unit, and also for the return of staff and equipment to their original base.

Relatives and conscious patients should be kept fully informed at all times. It is good practice where possible to obtain consent from the patient and next of kin before transfer.

### Case progression

The neurosurgeons accept the referral and wish the patient to be transferred direct to theatre. A postoperative critical care bed is available. The anaesthetic department provides an anaesthetist trained in transfer techniques for the journey and the emergency department provides a nurse, equipment and appropriate drugs. The coordination of the interhospital transport occurs rapidly and smoothly. The patient is transferred in a standard emergency ambulance. During discussion with relatives, the patient's wife asks about the dangers of moving her husband.

## QUESTION 4

What risks are incurred during interhospital transfer?

### Hazards during transport

There are many hazards during the transport of critically ill patients. Mostly, these pertain to the patient, but there are additional risks to staff and equipment. Hazards also vary depending on the mode of transport used. It is essential that all medical staff undertaking interhospital transfers have appropriate insurance cover for injury or death during their time away from their base hospital.

Critically ill patients are at increased risk of death or harm from transport.[2 8 12 23–25 27 32–34] A critical incident rate of 15% has been reported for interhospital transport.[2] Pre-transfer preparation is the key to minimising danger. Specific hazards of transport include the displacement or disconnection of tubes, cannulae and catheters, difficulty of monitoring and communication due to noise, vibration or interference and equipment failure. Many of these potential problems can be expected, and

by meticulous preparation and care during transport be minimised. Contingency plans must be in place for the common and also the immediately life-threatening incidents, should they occur. Patients may also be at risk by the environmental change (eg, hypothermia) and the physical act of movement (eg, unstable spinal fractures). Again, thorough preparation is necessary to expect and minimise these dangers.

Staff and patients incur risk by travelling in a moving vehicle, and, as is the case in a normal car journey, all should be suitably restrained. In a road vehicle, this restraint should not be removed until the vehicle is stationary. If the patient requires attention during transport, the vehicle should be stopped in a place where staff can intervene safely. Equipment is also at risk during transport, and should be suitably designed and robust. All equipment including electrical appliances such as ventilators, infusion pumps and monitors should be adequately secured before transport or they risk becoming a missile in the event of a vehicle crash or excessive movement.

Differing modes of transport are used for interhospital transfer, and the choice is influenced by urgency, travel distance, geographical factors, weather conditions and availability. Aeromedical transport presents some unique hazards. The staff involved in this mode of transport should be specifically trained and experienced. Environmental change with fall in barometric pressure, subsequent reduction in partial pressure of oxygen and increase in volume or rise in relative pressure of gas-filled cavities can all cause problems. Soft tissues may also swell, making bandaging, splints or casts tight. Loud noise, vibration and unusual movement can increase pain and cause nausea. Problems with communication are common to both fixed and rotary wing aircraft due to high ambient noise levels. This is commonly overcome using intercom headsets, but requires working knowledge of this equipment and also radio etiquette. Audible alarm systems from monitors and electrical equipment become obsolete in noisy environments and thus visible alarms should be used. Often, patient access and visualisation are compromised or limited by aeromedical transport compared with road vehicles. This final consideration may influence elements of patient preparation for transport.

Interhospital transport carries a small but identifiable risk of serious injury or death to staff due to accidents. Aeromedical transport, especially helicopter transfer, has the worst safety record. All staff involved in this type of transfer should be adequately insured and indemnified.

### Transport organisation

In England and Wales, the Department of Health report, Comprehensive Critical Care, recommended methods of critical care delivery including the formation of regional systems called critical care networks. These organisations are responsibile for training staff and developing guidelines for secondary transport of the critically ill and injured adult within defined geographical areas.[28]

Despite these recommendations in 2000 and subsequent ICS guidelines in 2002, many emergency departments still fall short of suggested standards.[2] Considering the volume of critical care transfers that originate from the emergency department, it is important for the specialty of emergency medicine to be involved in the continuing development of these networks at local and regional levels. This will allow organisation of transfer services to ensure adequate standards of care, quality assurance, critical incident reporting and auditing. Replacement equipment and new services may be required to fulfil recommended standards.

Dedicated transfer or retrieval teams may offer patient benefits and should be used when available. Local knowledge of both regional transport teams and hospital transport teams should be available and well publicised to maximise usage. New retrieval teams should integrate into existing systems to enhance rather than compete and thus improve the level of care for patients.

Formal training programmes with recommended competency-based assessments are encouraged to improve the knowledge and skills of the staff. These can be complemented by courses in the transport of the critically ill to ensure that the highest possible standards are met.

Local and regional coordinators should be appointed to oversee, advise and give feedbacks at a national level on the continuing state of critical care transfers. The quality of all transfers should be audited and critical incidents recorded. It is only through such processes that standards are maintained and improved.

## SUMMARY

Emergency departments will always be involved in the transfer of critically ill patients. To minimise risk, emergency departments should have trained and experienced personnel to ensure appropriate pre-transfer stabilisation, communication and transport preparation. Local, regional and national organisation of care for the critically ill patient can help ensure that training, equipment and personnel are of the highest recommended standards.

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