West Yorkshire
Critical Care & Major Trauma
Operational Delivery Networks

Critical Care Safe Transfer Training

Handbook

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The contents of this handbook are based on previous work done by the North of England Critical Care Network in their Training for Transfer Manual. We thank them for their support, help and permission to reproduce some material.

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This Handbook is dedicated to Dr Johnny Ball Consultant Anaesthetist at Bradford NHS Trust. Johnny was passionate about transfer medicine and regularly taught on the WYCCODN Transfer Training course.

Sadly missed friend and colleague

Johnathan Ball
1972 – 2018

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Yorkshire Ambulance Service

Contents

Chapter 1 - Objectives of the Course ▾

The objective of this course is to provide the candidate with the requisite knowledge and skills to be able to understand the complications and risks associated with transfer of the critically ill patient; to be able to plan and safely manage the critically ill patient during inter- and intra-hospital transfer; to become familiar with the equipment used during transfer.

The one day course is conducted as a series of lectures, interactive workshops and scenarios. This Handbook is provided as pre-course reading.

Completion of the course should not be viewed as validation of an individuals' competence as there is no assessment process. Competency should be assessed in the clinical area in accordance with your clinical role.

By the end of this course you should understand:

- The hazards of the transfer environment
- How to prepare various types of patient for transfer
- When a patient is ready to be transferred
- How to use your local transfer equipment
- How to calculate how much oxygen to take
- What to take and what to leave behind
- The importance of effective communication during critical care transfers
- The principles of human factors and their application to critical care transfers
- The ethical & legal aspects of critical care transfers
- The different types of transport that may be used
- The physiology of head injuries and how that may be applied during the transfer situation

Chapter 2 - Introduction ▾

The process of transferring critically ill patients within and between hospitals is increasingly common. Intra-hospital transfers are most commonly performed to enable diagnostic or therapeutic investigations and interventions, while inter-hospital transfers may be performed for a number of clinical or non-clinical (bed capacity) reasons.

The last published national data estimated that in excess of 11 000 patients were transferred between intensive care units (ICUs) in UK (Mackenzie, Smith, Wallace 1997). This figure had increased by about 10% on the previously published data from eight years earlier. Figures for the number of transfers are currently difficult to obtain as there is no national reporting system. There are on average 450 inter-hospital transfers within West Yorkshire Critical Care Operational Delivery Network (WYCCODN) each year.

This figure refers primarily to transfers of intensive care and high dependency patients travelling between hospitals, often from one critical care unit to another. This figure does not include the large number of patients transferred around the hospital on a daily basis for investigations and procedures. It also ignores the transfer of many other sick medical and surgical patients from one hospital to another that may not have been regarded as 'critically ill'.

Transfer of patients is not something that should be undertaken lightly. Patients should be meticulously resuscitated and stabilized prior to transfer. It is extremely difficult to perform any sort of procedure whilst on the move, be it in the back of an ambulance or in a hospital lift. Preparing a patient for transfer is all about making sure that intervention is rarely required en route.

We hope that the Critical Care Safe Transfer Training Course will provide you with the structure and rationale with which to approach this.

Critical Care Network ▾

The WYCCODN is a regionally based collaborative partnership, enabling clinical services to work together to promote the highest quality critical care services for the region.

The WYCCODN consists of key stakeholders from the 11 critical care units in the 6 Acute Trusts in West Yorkshire and Harrogate.

The total Critical Care bed capacity in the network is 123 (2021). This number reflects level 3/2 capacity which is used flexibly to meet service needs. The total bed stock is inclusive of all the specialist adult critical care beds for cardiac, neurosurgery and burns critical care. The population served by these beds is over 2.5 million.

The six member organisations are:

- Airedale NHS Foundation Trust
- Bradford Teaching Hospital NHS Foundation Trust
- Calderdale & Huddersfield NHS Foundation Trust
- Harrogate NHS Foundation Trust
- Leeds Teaching Hospitals NHS Trust
- Mid Yorkshire NHS Hospitals Trust

The Nuffield Health Hospital, Leeds are the only Independent Provider in West Yorkshire who have critical care beds. As such they have contributed to the course development and access the course to train staff.

There are also a number of Independent Provider Hospitals within the area who would, should a patient deteriorate, transfer into our critical care bed base.

Miles	Airedale General Hospital	Bradford Royal Infirmary	Huddersfield Royal Infirmary	Calderdale Royal Hospital	Pinderfields General Hospital	Leeds General Infirmary	St James' University Hospital	Harrogate and District Hospital	Nuffield Health Hospital, Leeds
Airedale General Hospital		11	23	18	38	23	25	25	
Bradford Royal Infirmary	11		14	12	20	11	14	24	
Huddersfield Royal Infirmary	23	14		8	23	18	21	37	
Calderdale Royal Hospital	18	12	8		24	18	21	39	
Pinderfields General Hospital	38	20	23	24		12	13	32	
Leeds General Infirmary	23	11	18	18	12		3	15	<1
St James' University Hospital	25	14	21	21	13	3		15	
Harrogate and District Hospital	25	24	37	39	32	15	15		
Nuffield Health Hospital, Leeds						<1			

This metric shows the distance in miles between each of the critical care units within the network.

Reasons for Transfer ▼

There are various reasons for transferring patients. Primary transfer refers to the initial into hospital, from home, place of injury or illness. It is vital that critically ill or injured patients are treated rapidly in an acute hospital in order to stabilise them or limit their injuries. However, there are several instances when such management may be followed by further (secondary) transfer to another acute hospital. It is these types of transfer that we are concerned with on this course. Reasons for inter-hospital transfer include:

Clinical Transfer / Tertiary Transfer	Transfer of a patient to another hospital for care or facilities that are not available within the referring hospital.
Repatriation	When a patient is transferred back to the host hospital when a suitable bed has become available and /or when specialist / tertiary care is no longer required.
Non-Clinical Transfer	Transfer of a patient due to insufficient bed capacity in the referring unit. Includes transfers between different hospitals within the same Trust.

The first two reasons for transfer may be of some benefit to the patient. However transfers due to lack of capacity in the referring hospital is unfortunately common, particularly during the winter months. Such a transfer is clearly of no benefit to the patient and indeed may even be of detriment.

Transferring patients due to lack of bed capacity can involve difficult decisions being taken. A common practice is to move a stable patient to make room for someone who is critically ill. Even with stable patients, a critical care transfer can have significant impact. Haji-Michael (2005) suggests a non-clinical transfer of this nature results in extended length of critical care stay for the stable patient being moved. Therefore the decision to transfer patients should never be taken without great thought.

Transfer of patients, who should do them? ▼

Inter-hospital transfer of patients is the ultimate in unsupervised work. The patient to be moved may often be one of the sickest in the hospital. It is essential that the staff transporting a critically ill patient are suitably experienced to do so. WYCCODN have developed a Transfer Risk Assessment Tool (Appendix 1) that should be used as a guide to determine who should transfer the patient. It is the referring consultant's responsibility to ensure that the transferring team have the necessary skills. If there is an even remote possibility of needing to undertake an intubation during the transfer, then the doctor or practitioner must have the appropriate airway skills to do so.

The transfer team must also be familiar with any other organ support such as ventilation or inotropic support required by the patient. Ideally they should have had supernumerary experience in inter-hospital transfer before undertaking it alone. They must be familiar with all of the transport equipment in use. A nurse or operating department practitioner will frequently accompany the doctor to transfer a patient. They must also be appropriately experienced in transferring patients and be familiar with the patient and transport equipment. The National Competency Framework for Registered Nurses in Critical Care (STEP 1 & 2) provides Intra & Inter Hospital Transfer Competencies for Nurses (appendix 2). The Royal Collage of Anaesthetist Core Level Competencies for a CCT in Anaesthesia are also in appendix 2.

Intra-hospital transfer is somewhat less 'unsupervised', with help usually being quickly available if needed. Such transfers will give trainee doctors and junior nurses the opportunity to learn the principles of safe transfer under various levels of supervision and allow them to demonstrate competencies in this area before they are required to transport patients unsupervised between hospitals.

Recovery Teams ▼

Some regions or specialist centres use their own recovery teams to go out to referring hospitals and transfer patients back to the receiving hospital themselves. Such teams are more commonly used in specialist areas such as paediatric and neonatal critical care. Adult retrieval teams also exist for extracorporeal membrane oxygenation (ECMO) transfers.

The advantages of such teams are that the team can be made up of suitably qualified individuals with appropriate specialist skills. They will be used to working together and will be familiar with their own transfer equipment. Staffing numbers from the referring hospital will not become depleted.

The disadvantages of sending out a retrieval team are that this will put increased staffing and financial pressures on the receiving centre and will require appropriate remuneration. Delays may occur if the team is not immediately available. Staff in referring centres may also potentially become deskilled.

At present a general adult retrieval team does not exist in our region, however Embrace is available for the transfer of critically ill infants and children in Yorkshire and the Humber and the ECMO centre at South Manchester will provide a retrieval team for adult patients referred to their service.

Guidelines ▼

There are a number of published guidelines relating to the transfer of critically ill patients.

In particular you should make sure you are familiar with the following:

AAGBI Safety Guideline - Interhospital Transfer (2009)The Association of Anaesthetists of Great Britain and Ireland. www.aagbi.org/publications/guidelines

Adult Critical Care Transfer Guidelines (2021) West Yorkshire Critical Care & Major Trauma ODN. Available at www.wyccn.org

Guidelines for the Provision of Intensive Care Services Edition 2 (2019) Joint Professional standards committee of the Faculty of Intensive Care Medicine and the Intensive Care Society.

Guidance On: the Transfer of The Critically Ill Adult (2019) Faculty of Intensive Care Medicine and Intensive Care Society. Available at www.ics.ac.uk

References ▼

Haji-Michael, P (2005) Critical Care Transfers - a danger foreseen is half avoided. Critical Care. 9, 343.

Mackenzie PA, Smith EA, Wallace PG (1997) Transfer of adults between intensive care units in the United Kingdom: postal survey. British Medical Journal. 314: 1455-6.

Chapter 3 - The Pathophysiology of Transfer ▾

LEARNING OUTCOMES

At the end of this chapter the reader should be able to

- Understand the static hazards associated with transfer
- Appreciate the significance of the dynamic hazards, including acceleration and deceleration and the effects these have on the patient during transfer
- Understand how to minimise the effects of these hazards during transfer

Critical Care patient transfers are guided by the Intensive Care Society - Transport of the Critically Ill Adult Guidelines (2019), Guidelines for the Provision of Intensive Care Services (2019) and within WYCCODN, the Adult Critical Care Transfer Guidelines (WYCCODN 2021). These standards state that to be able to safely transfer a critically ill patient the transfer team should, amongst other things, have knowledge of physiology and appreciate the effects of the transfer process, including the effects of the forces and hazards which come into force during the event.

In health, the body will be capable of accommodating and compensating for any forces and hazards encountered during the transfer; however a standard critical care patient has reduced ability due to critical illness. Any increase in magnitude of forces experienced, combined with the severity of the patient condition can combine to cause significant physical alterations during the process. Hazards encountered during transfers consist of both static and dynamic, all of which should be avoided or minimised and prepared for.

Static Hazards ▾

These hazards are the more obvious to understand and appreciate. Static hazards are those caused by the hostile environment experienced on transfer. These include:

- Temperature
- Noise
- Vibration
- Lack of space
- Poor visibility
- Atmospheric pressure/altitude

The back of an ambulance is a difficult environment to work in. It is extremely cramped.

Vibration due to the mobile vehicle makes it unsafe for staff to move around the patient and perform anything other than the simplest of tasks. Vibration may result in equipment becoming dislodged if it is not safely secured and may interfere with monitoring such as non-invasive blood pressure readings and oxygen saturation. Vibration effects can be minimised by meticulous attention to padding, protecting and securing any vulnerable parts of either the patient or the attached monitoring.

Noise may impair the ability to appreciate alarms and the normal auditory cues we use to gauge that all is well. Communication between team members may also be suboptimal.

Most forms of transport are cold and patients may become hypothermic if care is not taken to wrap them up well. Once again good preparation with packaging prior to transfer can reduce the hazard potential.

Poor visibility may be a problem during air transfers as lights may be dimmed. The effects of altitude will be described in the chapter covering modes of transport.

Dynamic Hazards ▾

The dynamic forces exerted during transfer are perhaps the least appreciated. Acceleration and deceleration forces placed on the patient during transfer, be that along a hospital corridor or at 50mph in an ambulance, can have profound effects on the patients physiology. Newton's 3rd Law states that 'for every action there is an equal and opposite reaction'.

Gravity and Acceleration ▼

A form of acceleration familiar to us all is gravity. Acceleration forces solid organs and fluids (e.g. blood) to shift within the body in the direction opposite to the applied pressure force. Additional acceleration or deceleration during transfer will have superimposed effects. As most patients are lying on a trolley with their heads towards the direction of travel, acceleration from the ambulance will be directed along the long axis of the body towards the feet.

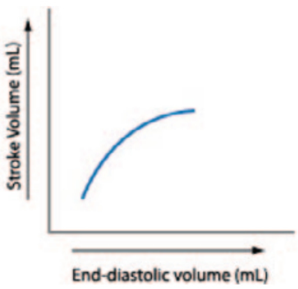
These forces may be of considerable magnitude. An ambulance braking hard may subject the patient to a force of 7-8 times that of gravity which is twice that experienced in a space shuttle taking off!

Acceleration leads to physiological disturbance mainly within the cardiovascular and respiratory systems. The disturbance varies with rate of acceleration, duration and direction in which it is applied.

Effects on the Cardiovascular System ▼

Acceleration in an ambulance with the patient usually supine and head in the direction of travel will tend to effectively force blood towards the feet. This is a similar phenomenon to the sensation of blood rushing to the feet when a lift accelerates upwards. This has the effect of decreasing venous return to the heart, reduction in cardiac output and reduction in blood pressure.

By virtue of Starling's Law, this fall in venous return will result in a reduction in cardiac output.



The greater the volume in the left ventricle the greater the stroke volume / cardiac output – up to a point

This will occur because the reduction in venous return or 'preload' will result in a fall in the end-diastolic volume of the right ventricle. This will result in reduced 'stretch' on the cardiac myofibrils, with a resultant fall in contractility and hence stroke volume. Starling's Law is illustrated graphically by the so-called Starling Curve above. If the stroke volume (SV) of the right ventricle is reduced, then the venous return to the left side of the heart will also fall and the left ventricular stroke volume will be reduced.

Since the cardiac output (CO) is dependent on the product of stroke volume (SV) and heart rate (HR), if the stroke volume falls but nothing else changes, then the cardiac output must fall. Similarly, as the mean arterial pressure (MAP) is governed by the product of the cardiac output and the systemic vascular resistance (SVR - how constricted the blood vessels are) then if the cardiac output falls but nothing else changes the blood pressure must fall.

$$CO = SV \times HR$$

$$MAP = CO \times SVR$$

Under normal, healthy circumstances the body would respond to a fall in venous return with an attempt to maintain its cardiac output and blood pressure via baroreceptor and vasoconstrictor reflexes. This is achieved by raising the heart rate and systemic vascular resistance by increasing the activity of the sympathetic nervous system.

Critically ill patients however are not able to mount these appropriate responses. The circulation is frequently dilated for example due to sepsis or an inflammatory response, the autonomic nervous system often does not work normally (dysautonomia) and many of the responses are obtunded by the use of vasodilating sedative drugs such as propofol. The venous return will also be further reduced in the ventilated patient due to the effects of positive intrathoracic pressure.

Thus in the critically ill patient a fall in venous return will commonly lead to a fall in blood pressure. This result will be exacerbated if the patient is hypovolaemic and will be improved in the patient with a normal blood volume or slightly hypervolaemic patient.

"Full" patients travel better

Thus **'full' patients travel better**. Always ensure your patients are fluid resuscitated before setting off and that the blood pressure is adequate. If in doubt give fluid. If fluid resuscitation alone does not result in an adequate blood pressure, consider whether vasoconstrictors or inotropes may be needed.

Hypervolaemic patients are rare but an example would be the patient with acute pulmonary oedema and elevated venous pressures. These patients should be sat up to reduce venous return. Diuretics and nitrates will act similarly and should be considered. The effects of acceleration in these patients may in theory be favorable, but deceleration during braking may increase venous return further and force the function of the ventricles further over the top of the Starling curve.

Although a patient may appear entirely stable while still stationary, transfer exacerbates their precarious physiology.

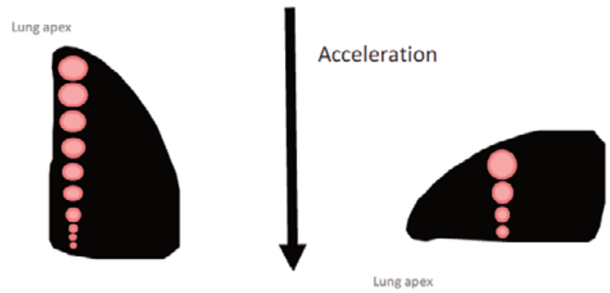
Prevention of the above potential hazards are best achieved by avoiding hard braking and the patient being 'head up' during transfer. On the whole, physiological derangements from deceleration are greater than those from acceleration due to the greater forces being exerted. A head-up position limits the forces exerted on the thorax and head during linear acceleration and deceleration.

Autonomic Nervous System ▼

Critically ill patients do not have a normal autonomic nervous system; they suffer from dysautonomia which is a condition in which the autonomic nervous system malfunctions. This can often result in them having a labile blood pressure in response to movement and turning and also blunted responses to hypovolaemia and hypotension.

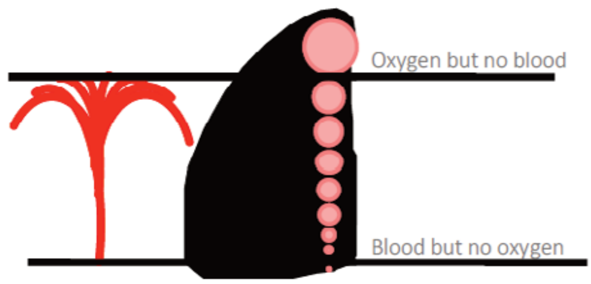
Effects on the Respiratory System ▼

The lung may be likened to a sponge filled with water. The effects of gravity are such that the alveoli at the apices tend to be stretched open whilst those at the bases will be squashed shut.



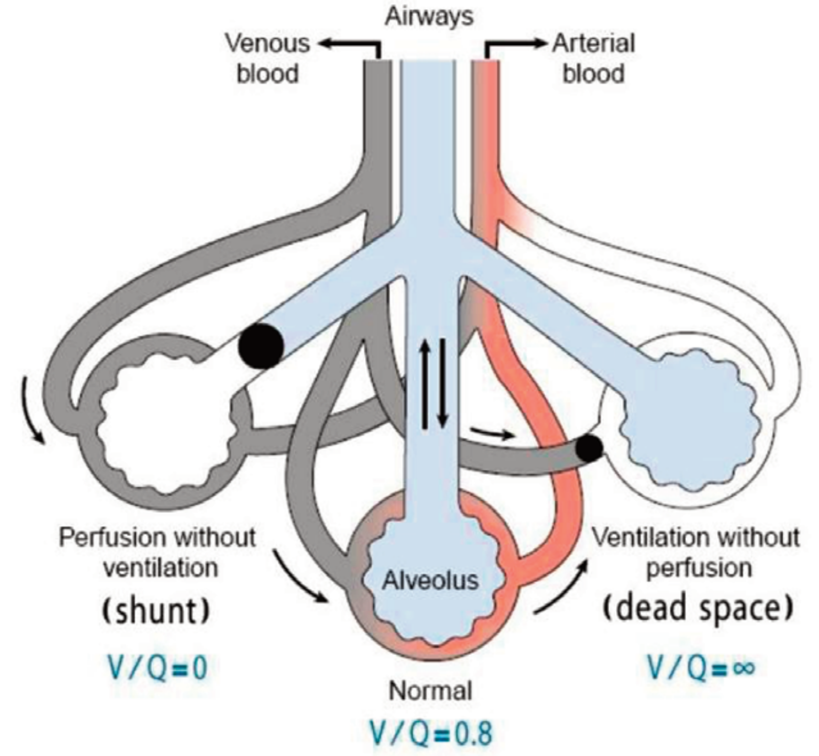
If the patient is lying supine, the distribution will be altered but still dictated by gravity with the dependent lung collapsed. If accelerative forces are superimposed upon this, then this will result in further areas of collapse in the direction of the force applied. This effect will be compounded by the inevitable basal and dependent atelectasis that develops in the intubated ventilated patient, caused in part by the upward pressure of the abdominal contents and diaphragm.

At the same time, gravity and acceleration have effects on pulmonary blood flow. Gravity will result in blood flow and lung perfusion being maximal in the dependent areas of the lung, whilst the apices or uppermost lung may have a fairly tenuous blood supply. Superimposed accelerative forces will simply exaggerate this effect, and if the acceleration is extreme then parts of the lung may not be perfused at all. These effects will be compounded by any fall in blood pressure, which will further reduce perfusion to the uppermost lung. We have already seen that acceleration may result in a fall in blood pressure, particularly in the hypovolaemic patient.



Thus the net result is an increase in the proportion of lung with ventilation and no perfusion. This is dead space and will result in an increase in $PaCO_2$.

Similarly there will be areas of lung with blood flow but no ventilation. The resultant shunt will result in hypoxia.



Adequate gas exchange takes place in well perfused and well ventilated lungs. The aim of good ventilation and maintenance of good perfusion is to eliminate:

- Dead space – ventilated lung with no perfusion
- Shunt – well perfused but poorly ventilated lung

Shunt and dead space are exacerbated by hypotension and hypovolaemia.

Effects on the Central Nervous System ▼

The effects on the neurological system may be difficult to assess during transfer due to many patients being sedated or unconscious during the event. They should, however be taken into consideration during the transfer particularly in patients with neurosurgical or neurological injuries. Both acceleration and deceleration forces are potentially detrimental. These effects may lead to alterations in venous drainage or blood supply to the brain. For example, hard braking in an ambulance may transiently impede venous drainage resulting in an increase in cerebral blood volume, raising intracerebral pressure.

The pooling of blood in the lower limbs and feet may reduce and inhibit blood supply to the brain causing cerebral ischaemia. In a patient with critically elevated intracranial pressure this may precipitate serious neurological deterioration and even coning. In health, excessive acceleration forces may lead to loss of peripheral vision, loss of vision with maintained consciousness or complete loss of consciousness. Seizures have also been reported following return of blood supply to the brain following cessation of the acceleration/deceleration forces. Although these symptoms may not be evident in the unconscious or sedated patient, it is important that they are considered, including the possibility of post transfer seizures.

Similarly, detrimental effects may result from tipping the patient head down, as may occur when moving up a ramp. Care should be taken to avoid this, and the head of the patient should be kept elevated to encourage cerebral venous drainage, once again excessive acceleration and deceleration should be avoided throughout the transfer.

Effects on the Gastrointestinal System ▼

Acceleration/deceleration effects on the GI system present as gastro-oesophageal reflux during exposure to such forces. This is best prevented by inserting a naso-gastric tube to either empty the stomach of contents or be left on free drainage to avoid vomit or aspiration. Transferring the patient in a head up position again is preferable.

Trauma Effects ▼

The main traumatic injuries to be considered due to potential acceleration/deceleration effects are vertebral fractures. Unstable fractures should be immobilised as much as possible and extreme forces avoided. Any fractures or traumatic injuries need to be considered and immobilised to aid pain management, cardiovascular stability and reduce further trauma.

So in summary: ▼

Accelerative forces during transport may result in:

- Decreased cardiac output
- Hypotension
- Increased dead space
- Increased shunt

Full Patients Travel Better: ▼

- Correct hypovolemia before setting off
- Correct hypotension before setting off (think vasopressors)
- Anticipate the need for
  - Increased FiO_2
  - Increased minute volume – consider invasive ventilation
- Avoid acceleration where possible (ambulance and hospital corridors)
  - Go slowly and steadily
  - Rarely a need for blue light or running along the corridor
- Consider position of patient in relation to direction of travel

References & Further Reading ▼

Adult Critical Care Transfer Guidelines (2021) West Yorkshire Critical Care & Major Trauma ODN. Available at www.wyccn.org

Guidelines for the Provision of Intensive Care Services Edition 2 (2019) Joint Professional standards committee of the Faculty of Intensive Care Medicine and the Intensive Care Society.

Guidance On: the Transfer of The Critically Ill Adult (2019) Faculty of Intensive Care Medicine and Intensive Care Society. Available at www.ics.ac.uk

Chapter 4 - Pre-Transfer Stabilisation ▼

LEARNING OUTCOMES

At the end of this chapter the reader should be able to

- Recognise changes in your patients' condition using an A to E approach
- Recognise relevant changes in blood biochemistry and metabolic derangement
- Ensure safety aspects are adhered to relevant to patients condition/speciality

This is an absolutely crucial part of any transfer, regardless of whether it is a simple trip to the CT scanner, or a long distance air transfer. Meticulous attention to detail is essential to avoid complications and deterioration en route. Time spent preparing the patient for transfer will be time saved in the long run. This section is all about dotting the 'i's and crossing the 't's.

Getting to know your patient ▼

This may not be necessary if you have been actively involved in a patient's care already, for example in the resuscitation room in Emergency Department (ED). Occasionally however you may be required to transfer a patient you do not know well. There is never any excuse for announcing to the receiving team on your arrival that you do not know the patient, and that you were simply called in to transfer them. You must know your patient in detail.

Thus, begin by reviewing the history, both short and longer term. Examine your patient thoroughly using an A to E assessment, paying particular attention to the state of the airway, breathing and circulation. Note what level of organ support the patient is receiving. Is this support stable? If the patient has been deteriorating and their support increasing you will need to address whether or not interventions to rectify this may be required before transfer. Review all investigations and note any abnormal results.

A - Airway ▼

The airway must be both patent and protected for transfer. Intubation in the back of an ambulance will not be a pleasant experience. Therefore if in any doubt intubate the patient. They can always be extubated at the receiving hospital if all is well.

Indications for intubation include:

- GCS < 9
- A GCS falling by 2 or more points, particularly if the deterioration has been in the motor score
- Seizures
- Facial injury
- Facial burns
- Inadequate oxygenation or ventilation

Patients with facial burns may appear to be safe at presentation; however they may rapidly develop airway and facial oedema over the next few hours making intubation extremely precarious. Any signs suggestive of airway burns such as a hoarse voice or singed nasal hair should be taken very seriously.

If your patient is already intubated, check the size of the tube and what length it is at the lips. Is the tube securely fastened? If not secure it. Make a note of the grade of laryngoscopy and whether any difficulties were encountered at intubation. Has the position of the endotracheal tube been checked on chest x-ray

B - Breathing ▼

The spontaneously breathing patient

Assess your patient's respiratory system. What is their work of breathing like? How much oxygen are they requiring and what is their oxygen saturation? What is the respiratory rate? Is it increasing or decreasing?

Are there any interventions or treatments that may improve respiratory function prior to transfer? These might include nebulisers, physiotherapy, chest drainage, diuretics, non-invasive respiratory support depending on the problem.

If the primary problem is respiratory and treatments have been initiated, has the patient started to improve, or are they deteriorating and beginning to look exhausted? Do they require ventilation?

A blood gas should be done. Ideally the gases should demonstrate that:

- PaO_2 > 13 kPa
- $PaCO_2$ < 5.5 kPa
- pH > 7.25

Clearly however this should be taken in the context of the patient, their presenting complaint, how much oxygen they are on, their age and comorbidity. A set of gases like this may never be achievable in the patient with COPD with chronic type 2 respiratory failure; indeed in such a patient it would be inappropriate to aim for such a high pO_2. Conversely, a young patient with acute severe asthma on high flow oxygen with these gases, who is starting to look exhausted, is clearly not yet fit to travel.

The ventilated patient

This patient will need to be stabilised on the transport ventilator. Set the ventilator with settings appropriate to the size and condition of the patient.

If the patient is already on a ventilator in ICU for example, and their condition is stable, then attempt to match the settings as closely as possible on the transport ventilator. Bear in mind the physiological effects of transport on the respiratory system and err on the side of giving a higher inspired oxygen concentration and higher minute ventilation.

Once your patient has been on the transport ventilator for 20 minutes, check an arterial blood gas.

As with the spontaneously breathing patient ideally aim for:

- PaO_2 > 13 kPa
- $PaCO_2$ < 5.5 kPa
- pH > 7.25

Again, this must be taken in the context of the patient however; a PaO_2 of only 13 kPa on 100% oxygen on a ventilator does not leave much room for manoeuvre! A lower $PaCO_2$ of 4.5 – 5.0 kPa should be targeted in head injury, and this will be discussed in the corresponding chapter.

Recheck the blood gases 20 minutes after any alteration has been made to the ventilator settings.

As with the unventilated patient, ask yourself if there are any interventions that may improve respiratory function and gas exchange before transfer.

Chest Drains ▼

Does the patient have chest drains in situ? If so, are they working, and has their position been checked on a chest x-ray?

If the patient does not already have drains in situ, do they need one? Drains may be indicated for pneumothoraces or large effusions. A ventilated patient with rib fractures should have drains placed even in the absence of a visible pneumothorax on x-ray.

During transfer, drains should be kept below the level of the patient, and should not be clamped for any reason.

C - Circulation ▼

Assess the patient's circulation. What is their heart rate, blood pressure, peripheral perfusion, venous tone and filling? Are there any signs of shock, such as confusion, oliguria, poor capillary refill, lactic acidosis? If signs of shock are present, what is the nature of the shock? Is it hypovolaemic, vasodilatory, or cardiogenic in origin, or a combination of these?

As discussed in chapter 2, hypovolaemic patients travel poorly. If you are in any doubt, give a fluid challenge and reassess the patient.

If signs of shock are still present after a reasonable fluid challenge ask yourself whether a CVP monitor may help and whether or not vasopressors or inotropes are indicated. If drugs such as these are commenced then transfer should usually be delayed until it is apparent that the drugs are appropriate and the rates of infusion relatively stable.

Ideally the following conditions should be met before the patient is moved:

- Pulse 60-120
- BP > 100 systolic
- Sinus rhythm
- Capillary refill time < 2s
- Catheterised with UO > 0.5ml/kg/hr
- Normovolaemic
- Inotropes/ vasopressors stable

As with all such criteria, they should be taken in the context of the patient, and are merely a sensible guide.

Electrolytes and Metabolic Derangement ▼

Major electrolyte disturbances should usually be corrected before transfer.

Potassium should ideally be in the range of 3.5 – 5.5 mmol/ litre. If it is lower, it should be supplemented, and if it is higher it should be reduced, either by medical means or by renal replacement therapy depending on the situation.

If the **magnesium** level is low and the patient is cardiovascularly unstable then this should be supplemented before transfer.

Similarly, **ionised calcium** should ideally be > 1.0 mmol/ litre

Abnormalities of **sodium** should normally be corrected slowly at no more than 0.5 to 1.0 mmol/ litre per hour. Attempts to correct rapidly before transfer should not be made as this may result in cerebral oedema or central pontine myelinolysis. An exception to this might be the patient with neurological sequelae of hyponatraemia such as seizures. In this situation it will be necessary to control the seizures before transfer, and this may require raising the sodium level to around 120 mmol/ litre relatively quickly using agents such as hypertonic saline. Correction thereafter however should be slow, and transfer need not be delayed until this has been achieved.

Abnormalities of **phosphate** may usually be corrected after transfer.

Infusions of electrolytes should not usually be taken on transfer. These should be disconnected and recommenced following transfer as indicated.

D - Disability ▼

Assess the patient's conscious level. If the patient is not currently intubated, ask yourself again whether the airway is being maintained and protected. If the patient is being intubated for low conscious level, document the neurological findings prior to intubation including any focal or lateralising signs.

If there is any possibility of raised intracranial pressure, for example in the patient with a head injury, then this must be managed appropriately, with particular attention paid to the prevention of hypoxia and hypotension and other causes of secondary brain injury.
Seizures should be controlled prior to transfer, even if this necessitates sedation and ventilation.

Sedation and analgesia should be administered via continuous infusion. Commonly used sedative drugs include propofol and midazolam, and analgesia is commonly provided with opiates.

Sedated patients are usually paralysed for transfer. Make sure that sedation is adequate before giving muscle relaxants. These drugs may be given as boluses to reduce the number of infusion pumps being transported.

Blood Glucose ▼

Always check the blood glucose. It should be maintained >4mmol/litre. A significant and prolonged period of hypoglycaemia may cause irreversible brain damage and must be corrected immediately. Following correction avoid the possibility of recurrent hypoglycaemia during the transfer by running an intravenous infusion of 10% dextrose. It is difficult to check blood sugars whilst on the move, so it is safer to risk the blood sugar running a little high than to risk it becoming low during the journey, particularly in the sedated patient.

Patients in intensive care are commonly on insulin infusions to counteract the hyperglycaemia associated with critical illness. Insulin infusions should generally be discontinued for the transfer. Such infusions require careful monitoring of blood sugar which is impractical. There will always be a risk of hypoglycaemia, particularly as any enteral or parenteral feed that was running will be stopped for the transfer. An infusion of intravenous glucose running separately is not a safe option either as the dextrose may inadvertently be stopped due to a dislodged cannula for example, leaving the insulin unopposed.

In the case of patients with type I diabetes, particularly one presenting with a diabetic ketoacidosis, insulin should be not be discontinued. The safest means of administering insulin in this setting will be as a Glucose Ketone Index (GKI) infusion, where insulin and dextrose are given concurrently.

Cervical Spine ▼

If the patient has been involved in trauma, has the cervical spine been cleared? If so, how and by whom? Has this been documented? What about the thoracic and lumbar spines? If there is any doubt then neck immobilisation must be maintained with a hard collar, sand bags and tape or similar, and the patient log-rolled.

E - Exposure ▼

Always ensure you fully expose the patient, particularly in the trauma setting, when a full secondary survey should be done to look for any other less immediately apparent injuries. This survey must be clearly documented.

Whilst it is important not to miss anything, it is also important to attempt to keep the patient warm, therefore exposure should be kept to a minimum and the patient kept covered as far as possible.

The transport environment is usually cold. Warm hypothermic patients to a safe level before you set off as they will only get colder. Ensure patients are wrapped up well for the journey.

Monitoring and Access ▼

The patient to be transferred should have at least 2 points of wide-bore venous access which must be carefully secured.

ECG and blood pressure must be monitored. The latter may be done non-invasively, but may not be accurate due to the effects of vibration during transfer and will significantly deplete the transport monitor battery. An arterial line is prudent in all but the most stable patients, and will be essential if inotropes or vasopressors are being administered.

A CVP may have been sited to assist with fluid resuscitation and administration of cardiovascular drugs. Subclavian or jugular lines should be checked on a chest x-ray before transfer.

Drains ▼

If anything can be drained and it would improve the patient's condition for transfer then it should be. Ventilated patients should have a nasogastric tube in situ, aspirated and then left on free drainage. In the case of a possible base of skull fracture the orogastric route should be used.

Patients should usually be catheterised and urine output monitored.

Bleeding ▼

Continuing blood loss should be stopped before transfer, by surgical means if necessary; fractures should be splinted or stabilised.

Occasionally this may not be possible, for example in the situation where the patient is being transferred for the purpose of actually stopping the bleeding. Examples include the patient with a leaking abdominal aortic aneurysm, penetrating chest trauma, pelvic fractures requiring pelvic embolisation and so on. Such patients may never truly be stabilised before transfer and may have to be transferred in a 'scoop and run' fashion (as opposed to the usual 'stay and play'). Such patients should be moved with the minimum of delay, and resuscitation continued en route as indicated. Such situations will be discussed in more detail in the lectures and scenario teaching on the course.

If blood products are to be transported with the patient these should be taken in an insulated blood product transport box. Let the blood transfusion laboratory know that the products are travelling with the patient and consider whether or not your lab should be liaising with blood transfusion at the receiving hospital in order to speed up the issuing of blood products following transfer.

References & Further Reading ▼

AAGBI Safety Guideline - Interhospital Transfer (2009)The Association of Anaesthetists of Great Britain and Ireland. Section 5, Page 9. www.aagbi.org/publications/guidelines/docs/interhospital09.pdf

Davies, G. & Chesters, A. (2015) Transport of the trauma patient, British Journal of Anaesthetics 2015. 115 (1) 33 - 37 www. resus.org Resuscitation Council (UK)

Guidance On: the Transfer of The Critically Ill Adult (2019) Faculty of Intensive Care Medicine and Intensive Care Society. Available at www.ics.ac.uk

Patient Safety Solutions (2007) World Health Organisation. Vol 1, Solution 3

Checklist ▼

The following pre transfer checklist is incorporated into the WYCCODN Transfer Form. It should be completed and signed immediately before departure as a final check that preparations are complete.

Key Point:
Simplify as much as possible without compromising patient care and safety.

Pre transfer Checklist

Critical Care transfer to another hospital
Check sheet for preparation of a patient transfer to another hospital

Details of person completing pre transfer check sheet

Name...

Designation ....

Signature ....

Date ☐ **Time** ☐

Before Moving The Patient Consider:

Reason: Can the patients needs be met within the existing hospital
Timing: Does this transfer need to be done at this time
Team: Are the right people available to conduct the transfer safely
Transport: Booked and reference number documented
Risk: What are the predictable risks & will the base hospital be exposed whilst the team are deployed

Preparing For Transfer:

E	Equipment	Establish on transfer ventilator and secure patient on trolley Full monitoring to ICS standard Emergency drugs, oxygen and fluids available Transfer bag checked (including battery back up) Consider spinal immobilisation if necessary Specialist equipment e.g. balloon pump, warming blankets	☐ ☐ ☐ ☐ ☐ ☐
S	Systematic	Full ABCDE assessment Confirm airway secure 2 Working and accessible intravenous access points Confirm patient stable and suitable for transfer	☐ ☐ ☐ ☐
C	Communication	Inform patient (if not sedated) and family Confirm transfer, requirements and ETA with receiving unit Mobile telephone available	☐ ☐ ☐
O	Observations	Commence inter-hospital transfer charting Full set of observations recorded Confirm patient is stable and suitable for transfer	☐ ☐ ☐
R	Recent Investigations	Handover documentation completed Recent investigation results including arterial blood gas Confirm radiological images transferred electronically	☐ ☐ ☐
T	Team	Skill mix of transfer team appropriate Protective clothing / high visibility jackets available Is the unit safe to leave?	☐ ☐ ☐

After Transfer

Team debrief / Restock transfer bags / Submit Network audit data
Send middle (pink) copy of Transfer Form to WYCCODN office for audit purposes

Chapter 5 - Monitoring ▼

LEARNING OUTCOMES

At the end of this chapter the reader should be able to

- Understand the minimal monitoring requirements when transferring critically ill patients

Transferring any patient in an ambulance can be a stressful experience. It is an isolated environment and offers little of the normal back-up systems that one can expect in a hospital setting.

Throughout the transfer, monitoring of the patient should be of at least the same standard as that which the patient would receive if he/she were not being transferred. In many cases levels of monitoring may even be higher during the transfer.

This chapter looks at factors to consider when deciding which parameters to monitor. There are various transfer monitors on the market and it is essential that you are familiar with the settings and functions of your particular monitor prior to setting off on the transfer.

A written record of patient status, monitored values and other information should be completed during the transfer. This should be documented on the WYCCODN transfer form (Appendix 4).

Minimal Monitoring Standards ▼

The UK Intensive Care Society (2011) recommendations for monitoring suggest that the standard of care and monitoring during transport should be at least the equivalent of the standard at the unit you are leaving. The minimum acceptable monitoring for all patients during a transfer includes:

- ECG
- Continuously displayed invasive blood pressure measurement
- Pulse Oximetry
- End Tidal Carbon Dioxide for ventilated patients
- Body Temperature – preferably core

The patient should be connected to the transfer monitor prior to the commencement of the transfer to ensure that all monitoring parameters are working correctly. The monitor should be fully charged and should be kept plugged into the mains for as long as possible prior to starting the transfer. Once in the ambulance the monitor should be connected to the 12volt socket in order to preserve the battery life.

Monitoring must be continuous throughout the transfer and the monitor must be visible to accompanying staff at all times.

ECG Monitoring ▼

ECG monitoring is essential on any transfer of a critically ill patient. Three lead ECG monitoring is adequate in most cases, but 5-lead ECG monitoring may be useful in the detection of myocardial ischaemia. Always ensure that the skin electrodes and leads are well secured before departure; if one becomes disconnected the trace will be lost.

Blood Pressure Monitoring ▼

Intermittent non-invasive blood pressure is unreliable in a moving vehicle as it is sensitive to motion artifact. In addition, the pump consumes a significant amount of power and can shorten battery life.

Continuous invasive blood pressure monitoring via an arterial line minimizes these problems. This will necessitate the insertion of an indwelling arterial cannula. This must be connected to a pressurised bag of saline run through a giving set incorporating a flushing device. The pressure within the system is then transduced and the waveform displayed on the monitor. The level of the transducer needs to be secured at the level of the patient's right atrium, or pressure readings will be inaccurate.

The pressure bag should remain vertical. If it is placed in a horizontal position the tap on the giving set must first be closed to prevent air embolism from the drip chamber during flushing of the line, or bubbles of air entering the giving set tubing. Both of these may dampen the waveform trace or worst still, enter the patient's vasculture and lead to air embolism.

During transfer the arterial line must be accessible, visible and must be clearly labeled to avoid inadvertent intra-arterial injection.

Pulse Oximetry ▼

Pulse oximetry relies on the fact that oxyhaemoglobin and deoxyhaemoglobin have different absorption spectra. The oximetry probe emits light of wavelength 660nm and 940nm, and the amount of each wavelength absorbed is used to calculate the percentage of oxyhaemoglobin present.

Pulse oximetry has various shortcomings including inaccuracy in the face of hypotension, poorly perfused digits and irregular heart rhythms. Motion artifact during transfer may significantly disturb the function of this monitoring device, and vibration may lead to the probe position being dislodged.

It should be remembered that pulse oximetry tells us only about arterial oxygen saturation and gives no information about the adequacy of ventilation, hence the importance of using capnography in ventilated patients during transfer and checking arterial blood gases prior to departure.

Temperature ▼

Temperature monitoring is important, particularly in children, and ideally should be peripheral and central if the monitor allows both. A nasopharyngeal probe may be used to monitor core temperature in the ventilated patient.

Monitoring of Ventilated Patient ▼

In addition to the minimum monitoring requirements which are outlined above all ventilated patients also need the following continuous respiratory monitoring

- End Tidal Carbon Dioxide ($EtCO_2$)
- Oxygen Supply
- Inspired oxygen concentration (FiO_2)
- Airway pressures
- Ventilator settings

End-tidal Carbon Dioxide and Capnography ▼

A capnograph measures the amount of carbon dioxide present in the patient's inhaled and exhaled gases. The CO_2 level will be seen to fluctuate with respiration, falling to zero during inspiration, then rising to a peak at the end of expiration. The latter value is the 'end-tidal CO_2'. If the patient has relatively normal lungs it will usually be found to be approximately 0.5 kPa lower than the true arterial PCO_2.

The capnograph can give us a lot of information: it will give us an early indication of ventilator failure or circuit disconnection; it will tell us about the adequacy of ventilation and the respiratory rate; a steep upslope to the expiratory trace may signify bronchospasm.

Other monitoring that may be present ▼

Central venous access may be required for the delivery of inotropes and vasoconstrictors during transfer. An assessment of fluid status must be made prior to transfer as central venous pressure (CVP) monitoring has limitations is the assessment of intravascular status. Remember fuller patients travel better. If CVP is monitored during transfer the same precautions regarding the pressure bag and transduce height should be taken as were discussed for invasive blood pressure monitoring.

Pulmonary artery (PA) catheters are less common in practice but they may be used to measure cardiac output by thermodilution. This is impractical during a transfer. If a PA catheter is in situ then the PA waveform should be continuously displayed to avoid unrecognized wedging. If the waveform cannot be continuously displayed then the catheter should be withdrawn to the Superior Vena Cava (SVC).

Alternative cardiac output monitoring, e.g. LiDCO, oesophageal doppler are cumbersome, have multiple cables are limited battery life. They would only be used in exceptional circumstances with appropriate expertise.

Intra-cranial pressure monitoring may be present in certain circumstances for patients with head injuries or other intracranial pathology. Once again these monitors are bulky and the readings may be subject to motion artifact.

All alarms on monitors, infusion devices and ventilators should be visual as well as audible as with the general ambient noise level of an ambulance, audible only alarms will be easily missed.

Key Points:
Connect monitor to 12 volt socket and remember all monitoring and equipment alarms should be audible and visible at all times

References & Further Reading ▼

Guidance On: the Transfer of The Critically Ill Adult (2019) Faculty of Intensive Care Medicine and Intensive Care Society. Available at www.ics.ac.uk

Chapter 6 - Equipment ▾

■ LEARNING OUTCOMES

At the end of this chapter the reader should be able to

- Understand the characteristics of transfer equipment
- Appreciate the importance of knowing how to use the equipment you will use when transferring the critically ill patient

In 2019 the Intensive Care Society (ICS) published its updated Guidelines for the Transport of the Critically Ill Adult, setting standards for both monitoring (see chapter 5) and equipment. They apply not only to patients transferred between hospitals but also to those patients moved between departments within a hospital. The WYCCODN transfer guidelines (2021) have been formed on the basis of the ICS Guidelines (2019).

In addition to this, CEN (Comité Européen de Normalisation) guidelines exist. CEN is essentially a European Committee for Standardisation and has published 2 standards that have subsequently been adopted by the British Standards Institute: BS EN1789 and BS EN 1865. These relate to ambulance design and ambulance equipment design. Their aim is to ensure, throughout Europe, that ambulances and the equipment they carry are constructed to the highest standards, increasing patient and staff safety through standardisation of equipment and improved crash protection.

This chapter will look at the general characteristics of transfer equipment design for the inter- and intra-hospital transfer of critically ill patients. Some of the equipment and the trolley functions will be demonstrated in the workstations on the course.

Some of the direct risks to the patient relate to the illness he/she is suffering from at the time. However, many risks are due to problems arising from equipment failure during the transfer e.g. battery failure in a monitor or in a syringe pump.

Since any transfer vehicle has a limited amount of equipment on board, this means that the transferring staff must ensure that they have adequate back up systems in place to replace any malfunctioning equipment.

However, there is a balance between what you can be expected to take with you in the limited space of an ambulance.

Equipment used for transfers should be dedicated to and designed for that role. This ensures that equipment is available when needed without the tedious chore of running around gathering up a random selection of equipment at the last minute. It is essential that all equipment used for transferring patients is serviced in line with manufacturers recommendations.

General Characteristics of Transfer Equipment ▾

The equipment used to transfer critically ill patients between or within hospitals must meet certain basic criteria to ensure it is fit for purpose. Much of the equipment available for transfer has been specially designed to meet the requirements of transfer. All staff involved in transfers should be trained and understand the principles of operation of the equipment they use, so reducing critical incidents to a minimum by problem identification and prevention.

Transfer equipment choice should be based upon the following factors:

- Weight – major contribution from batteries and mechanical parts
- Size – the size of the incorporated screen is often the major determinant of equipment size
- Power supply – battery life of at least 4 hours, preferably lithium ion, and ideally it should be possible to change batteries without loss of equipment function, but the equipment should also be mains compatible
- Display type – size, resolution, screen type, avail able viewing angle – clear illuminated display with wide viewing angle is the ideal
- Number and type of available parameters – most important in monitor and ventilator configurations,

- Robustness – important to check if drop tested by the manufacturer as monitors, ventilators and syringe drivers will all be dropped at some point
- Alarm features – must be clearly audible and visible on the screen
- Trend recording of parameters useful
- User friendliness
- Compatibility with other equipment
- Local preferences
- Cost

Power Supply for Equipment ▼

All equipment should have robust self-contained battery supplies and be kept on charge when not in use to ensure mission readiness when required. The health of these batteries should be closely monitored as part of routine equipment checks. However, it is useful to run these items of equipment off the mains supply whenever possible to maximise battery life when needed. This applies when stabilising a patient prior to transfer but also in the ambulance. Most ambulances will have 12volt DC output available that can be utilised via a suitable inverter to run the majority of transfer equipment. Dedicated transfer trolleys can be fitted with such inverters. Increasingly newer vehicles are also supplied with 240volt AC [A.2] outlets which are starting to make life much easier when utilising vehicle power for transfers. Equipment battery health is still important when using the equipment away from base but outside the ambulance.

Monitors ▼

An ideal monitor should be a multifunction device with a robust construction and an easily viewed colour illuminated screen. It should have at least two invasive monitoring channels in addition to ECG, SpO_2, capnography and temperature measuring capability. They should be easy to use and the screen should provide good visibility even in direct sunlight. Alarms should be both audible and visible. The ability to print out monitoring data at the end of the trip from an integral printer is also very useful. Like with all transfer kit the casing should be robust enough to handle the inevitable rough treatment without having to be sent back for repair at regular intervals. Battery life should be reliable and the ability to "Hot Swap" batteries without switching off is a bonus.

Philips Intellivue MP30 Patient Monitor

GE Systems INC. DASH 3000

Welch Allyn PROPAQ CS

Above are examples of patient transport monitors.

Ventilators ▼

Transport ventilators should be able to deliver variable oxygen concentrations across a range of ventilation modes from fully controlled IPPV through to supported breathing modes such as SIMV, BiPAP and CPAP with Pressure Support. They are usually electronically controlled gas driven units. In addition, an ability to provide supported ventilation via mask CPAP or BiPAP without high gas consumption would be a bonus.

PEEP should be controllable within the ventilator and pressure limits fully adjustable. Alarms should cover low and high pressure warnings, disconnect, apnoea and respiratory rate. Electronic graphical displays of settings and spirometry data are also useful.

Drager Oxylog 3000 transport ventilator.

Before use a formal device check should be done with a test lung attached. This will test all the ventilator functions before use. Failure of any test should be reported to your local medical physics department immediately.

Whatever model of transfer ventilator you use, it is essential that the fundamental back-up of a self-inflating (Ambu) bag is available at all times, in the event that there is a complete loss of oxygen supply or ventilator malfunction.

Chapter 8 discusses in detail oxygen delivery and how to calculate how much oxygen you will need for the transfer.

Drug Delivery Devices ▼

There are many different syringe drivers available that are suitable for use in critical care transfers. Different hospitals will have different types of syringe drivers and you need to be familiar with the ones you will be expected to use.

Alaris Carefusion Syringe Drivers

B Braun Space Infusion System

Important features of appropriate critical care syringe drivers are:

- Ability to use a variety of syringe sizes
- Suitable for infusions commonly used in critical care
- Able to change rate without interrupting the infusion
- Able to give bolus of drug without interrupting the infusion
- Clear legible display
- Ease of use – depends on experience.
- Long battery life if rechargeable or the ability to run off easily obtainable AA size batteries.
- Robust and lightweight with secure fixing device for trolley or drip stand.
- Infusion pumps should ideally clip together for ease of handling.

In general, there is little need for continuous infusion by volumetric pumps (see chapter 7). Either infusions can be stopped or the drugs can be administered by syringe pump. Volumetric pumps tend to be bulky, heavy and rely on somewhere to hang the bag but modern designs and functionality are improving.

Key Points:
Rationalise the number of infusion devices you need by reducing the number of infusions.

Transfer Trolley ▼

All units within the WYCCODN use a Ferno fixed-height Critical Care Trolley for inter hospital transfers. This is a trolley that allows the other medical equipment to be stored underneath the patient, increasing stability. It also has holders for 2 oxygen cylinders with retaining mechanism.

The trolley should be kept on charge at base whilst not in use via the 3 pin plug and extension socket provided. The trolley's equipment should be kept plugged in and charging where possible. It is important to ensure that the ambulance crew have enabled the electrical supply in the vehicle before use – they will help you with this.

Vacuum Mattress ▼

Some units may use a vacuum mattress when transferring critically ill patients. The mattress helps secure patients into position during transfer. The patient is placed upon the mattress and it is then loosely wrapped around them. Air can then be sucked out using the pump provided or a suction machine via a one way valve. Whilst removing air, the mattress will mould to the contour of the patient. The harnessing belts can then be secured and tightened.

The mattress has side carry handles which can be used when transferring the patient to the trolley. It also has the benefit of keeping the patient warm.

It is essential when using a vacuum mattress monitoring cables and drainage systems are secure but not putting pressure onto the patient. You must also still be able to access vascular ports for the delivery of emergency drugs.

Other Portable Equipment ▼

Portable Suction Unit - It is envisaged that the suction unit will be the least used piece of equipment on the trolley. It usually has a battery life of over 45 min on maximum suction when fully charged (check yours). It should be remembered that prior to leaving the parent unit there will be wall based suction available and whilst in an ambulance, suction will also be available to use.

Ambu bag - this self-inflating bag-valve-mask assembly should be available for all transfers in case of ventilator failure.

Defibrillator - available on the ambulance

Transfer bags - although the design may vary from unit to unit, they should be easily accessible and easily portable. The contents of the transfer bag for inter-hospital transfers are standardised across WYCCODN (Appendix 3). It contains emergency airway, breathing and circulation equipment. The transfer bag and its contents must be checked regularly in line with your local unit/department policy and particularly prior to transfer. It must also be restocked immediately after use. The contents should not be changed without consensus opinion. Each bag should contain or have prominently displayed contents list to enable restocking and familiarisation. The bag should enable you to solve problems quickly. Any drugs that you anticipate using should be carried in a separate pouch.

An example of a Critical Care Patient Transfer Bag

Key Points:
Know your equipment, how to troubleshoot and be familiar with the contents of the transfer bag.

References & Further Reading ▼

Adult Critical Care Transfer Guidelines (2021) West Yorkshire Critical Care & Major Trauma ODN. Available at www.wyccn.org

Guidance On: the Transfer of The Critically Ill Adult (2019) Faculty of Intensive Care Medicine and Intensive Care Society. Available at www.ics.ac.uk

Chapter 7 - Drugs & Infusions ▾

■ LEARNING OUTCOMES

At the end of this chapter the reader should be able to

- Describe the rational for administering drugs and infusions on a transfer
- Identify which drugs are best given as boluses and which as infusions
- Identify which drugs are not suitable for administration during a transfer and possible alternatives if necessary
- Describe how to prepare drugs and equipment ready for transfer including amounts
- Identify risks associated with drug administration during transfer

In this section we will look at the drugs we may need to take on a transfer. Generally drugs may be administered as either boluses or as infusions. It is important that the number of infusions taken on transfer is kept to a minimum. Anything that may be discontinued safely for the journey should be, and any drugs that may be given by bolus should ideally be given before departure.

Infusions ▼

Infusions on transfer are generally administered by syringe driver. Volumetric pumps and gravity drips should be avoided if possible. The number of infusions should be kept to a minimum, and it will usually be possible to rationalise the infusions to **analgesia, sedation** and **vasoactive** medication. Any other drugs should be discontinued if possible or an intermittent bolus given.

Changing syringes in transit should be avoided at all costs, and the amount and concentration of drug in the syringe should be sufficient to last for at least **double the journey time** or a minimum of **one hour.** Consider doubling or quadrupling inotrope concentrations to avoid syringe changes. Drug infusion rates should essentially be stable before leaving. **Any changes to the 'normal' drug concentrations should be clearly communicated to the transferring and receiving team to avoid accidental overdose.**

Infusion pumps should be fully charged before setting off and left plugged into the mains supply until departure. They must be carefully secured and should not rest upon the patient. Ideally infusions should be secured at around the level of the patient's heart or below. If placed above the level of the heart, there is a danger of free-low or syphonage into the patient. This may result in serious overdose of drug. This risk is reduced by using anti syphon lines.

Transferring personnel **must** be familiar with the functions of the syringe drivers in use.

Bolus Drugs ▼

Most other drugs may be administered as boluses. It is essential that a **free port** for the administration of drugs is identified and accessible during the journey. The flush line on a central line is often useful for this. It is important to ensure that the pressure bag and drip chamber on the giving set are held vertical when the flush is used to avoid air embolism.

Muscle relaxants should be bolused after ensuring adequate sedation of the patient. A dose should be given immediately before departure and extra taken for administration en route as necessary. It is probably safer to give too much relaxant rather than too little, to avoid the patient coughing during the journey, with the potential for endotracheal tube dislodgement and barotrauma.

Any drugs that may be given before transfer such as antibiotics, gastric protection, steroids etc should be. Other drugs that should be taken on transfer in case of emergency will depend to an extent on the nature of the patient. Drugs to be considered will include emergency drugs such as adrenaline and atropine, mannitol, vasoactive drugs such as ephedrine and metaraminol, induction drugs and suxamethonium for use in the unlikely event of having to anaesthetise and intubate an as yet unintubated patient.

What may be left behind? ▼

Any infusions that may safely be discontinued and left behind for the duration of the trip should be.

Disconnect **maintenance fluids** if possible, particularly where these are being administered by volumetric pumps; a bag of colloid or crystalloid run through a giving set may be taken on the journey to bolus if necessary.

Discontinue **enteral or parenteral feeds.** Aspirate the stomach and leave nasogastric tubes on free drainage.

Infusions that require close monitoring, and that would be particularly dangerous if bolused should be temporarily stopped. Examples include infusions of **electrolytes,** and **insulin.** Many critically ill patients develop hyperglycaemia associated with their illness, steroid administration, feed composition etc. Insulin may usually be safely discontinued for transfer in these patients. Occasionally it may be undesirable to discontinue insulin; an example might be the type 1 diabetic who has presented with a diabetic ketoacidosis (DKA). Insulin in such a situation may be more safely administered as glucose to ketone index (GKI).

Key Points:

Rationalise the number of infusions you need during transfer.

Document all drugs administered during transfer on the transfer form.

References & Further Reading ▼

AAGBI Safety Guideline - Interhospital Transfer (2009) The Association of Anaesthetists of Great Britain and Ireland. www.aagbi.org/publications/guidelines/docs/interhospital09.pdf

Chapter 8 - Oxygen ▼

■ LEARNING OUTCOMES

At the end of this chapter the reader should be able to

- Recall the properties of oxygen and how it is stored, including the working of the pressure gauge on cylinders
- Understand the oxygen supplies available during a transfer and how/when they should be utilised
- Revise methods of delivery of oxygen to patients during transfer
- Understand and perform calculation of oxygen requirements for transfers

Oxygen is a colourless, odourless, tasteless gas which cannot be liquefied above a critical temperature of -119ºC . In other words, at room temperature it will always exist as a gas regardless of how much pressure is applied.

Oxygen is essential for life due to its role in the process of oxidative phosphorylation. It is necessary to take oxygen on a transfer of any critically ill patient. We therefore need to understand how it is stored, and how to calculate how much to take with us.

Oxygen Storage ▼

Our oxygen supply may either be derived from cylinders or from a piped medical gas system.

Oxygen Cylinders ▼

In the United Kingdom, oxygen is stored in black cylinders with a white shoulder. These cylinders are made of molybdenum steel, and oxygen is stored within them as a gas under pressure. A pressure gauge attached via the brass valve at the top of the cylinder will tell us what the pressure inside the cylinder is.

Regardless of the size of the cylinder, when full at room temperature it will have a pressure of 13,700 kPa or 137 Bar above atmospheric pressure. As the cylinder is emptied the pressure within it will fall in direct proportion to the amount of gas left inside. In other words, when the cylinder is only half full, the gauge will read approximately 6850 kPa. Helpfully, gauges are often clearly labelled with markers indicating that they are full, half full, nearly empty etc.

The type of gauge and connection that is attached to the cylinder will depend on how you intend to administer the oxygen; if it is to be used with a transport ventilator, a Schrader valve connection will be needed, whereas if oxygen tubing is to be attached, a 'fir tree' nozzle connection will be required.

Schrader valve

Fir Tree Nozzle

Cylinders come in different sizes ranging from A to J, with J being the largest. Sizes D, E and F are those most commonly used in hospitals. Size E is the cylinder size commonly attached to our anaesthetic machines. Most emergency ambulances carry two size 'F' cylinders for the internal supply in the vehicle and one 'D' size cylinder. The internal supply should be used for the patient wherever possible. Oxygen supply taken along by the transfer team should be reserved for use to and from the vehicle.

The "CD" lightweight composite Kevlar Fibre cylinders are also available in some hospitals. This cylinder is 25% lighter than a conventional "D" size steel cylinder but holds 35% more O_2. It has an integral cylinder on/off valve, flow meter, Schrader probe socket and a continuously live contents gauge.

The contents when full in each of these cylinders are as follows:

BOC Cylinder size (other manufacturers contents may vary - please check your local supplier)

	C	D	CD	E	F	G	J
Filling Pressure at 15 degrees (bar)	170	170	230	170	170	170	170
Height (mm)	430	535	550	865	930	1320	1520
Capacity (litres)	170	340	460	680	1360	3400	6800
Duration (mins) at 10l/min	17	34	46	68	136	340	680

It is important to have access to these numbers as we use them to calculate how much oxygen is required for the transfer.

Piped Oxygen Supply ▼

This refers to the hospital supply of oxygen. It is delivered from a central supply point to various sites in the hospital via hidden copper pipe work. It is accessed via gas-specific white Schrader valves found on wall outlets or ceiling pendants. The oxygen cable from the transport ventilator will connect directly to this valve. Alternatively, a flow meter attachment may be attached to the valve so that oxygen tubing may be used; this is the type of attachment found at the bedside in most wards so that oxygen may be delivered via a face mask.

Whenever piped oxygen is available, this should be used in preference to your oxygen cylinders, simply to conserve your supply. Piped oxygen will be available in most ward areas, ED, ambulances, and scan rooms; you should switch from cylinder supply to piped supply as soon as possible after arriving in an area where piped gases are available

Although piped gases are widely available throughout the hospital, do not assume it will be available. If you are unsure, check in advance.

Oxygen Calculations ▼

It is essential that you are able to calculate roughly how much oxygen you are likely to need for any given journey.

Always take sufficient oxygen to last for **twice** the expected journey or as a minimum enough for **one hour**. So for example, for a 40 minute journey, take enough for 80 minutes; for a 15 minute journey take enough for one hour.

- Spontaneously breathing patients on face masks

This is a simple calculation to make.

If you have a patient breathing oxygen via a face mask at 8 litres per minute undergoing a 20 minute transfer, how much oxygen will you need?

For a 20 minute transfer you will need to take enough for one hour i.e. 60 minutes.

You will therefore require

Amount 8litres/min × Time 60mins = 480 litres

You will therefore need at least 2 size D cylinders, or preferably a single size E. If possible avoid changing cylinders during your journey and take a larger cylinder rather than multiple small ones.

■ Ventilated patients

In this situation you will need to know the journey time, how much oxygen the patient is using, and also how much extra oxygen is needed to drive the ventilator.

Most transport ventilators are gas driven. The Oxylog 2000 uses around 1 litre per minute, whilst the more advanced Oxylog 3000 uses up to 0.5 litres per minute. The Oxylog 3000 also rather helpfully displays exactly how much oxygen from the cylinder is actually being used at any one time which makes the calculations a lot easier, but you still need to understand the principles.

In this situation you will need to know the journey time, how much oxygen the patient is using, and also how much extra oxygen is needed to drive the ventilator.

If you have a ventilated patient on for example an Oxylog 2000 ventilator, on 100% O_2, ventilated with 600ml tidal volumes 15 breaths per minute, travelling on a one hour transfer, what do you need to know to calculate how much oxygen to take?

How much oxygen is the patient using? For this we need to know the patient's minute ventilation (how much they are being ventilated each minute). This is equal to the product of the tidal volume (the size of each ventilator breath) and the frequency of ventilation.

Tidal Volume e.g. 600mls × Breaths per min 15bpm = 9000mls = 9 litres per/min

As the patient is on 100% O_2, then they will be consuming 9 litres of oxygen per minute. The ventilator also consumes around one litre per minute; therefore 10 litres per minute will be required.

We are going on a one hour transfer; therefore we must take sufficient oxygen for 120 minutes.

Amount 9 litres + 1 litre × Time 120 mins = 1200 litres

This may be provided by taking either 2 size E cylinders, or a single size F cylinder.

Note that we have the option of giving patients 'airmix' on the Oxylog 2000. This is a 50:50 oxygen: entrained air mixture resulting in approximately 60% inspired oxygen. If the patient is on 'airmix', then only half of the calculated minute ventilation will be drawn from the cylinder.

In the above example this would result in the patient requiring just 4.5 litres per minute of oxygen. The ventilator however still uses 1 litre per minute, and the total requirement will be:

Amount 4.5 litres + 1 litre × Time 120 mins = 660 litres

When using the Oxylog 3000, the ventilator will display the total oxygen requirement (for patient and ventilator) for the current ventilation parameters and oxygen percentage. This is expressed in litres per minute and need only be multiplied by the number of minutes required to calculate the total needed for the journey.

Non-invasive ventilation ▼

The Oxylog 3000 may be used to provide non-invasive ventilation with appropriate masks. The ventilator will compensate for any leakage of gas around the edges of the mask. Due to leakage of gas the requirements will be higher than if the ventilator were being used for invasive ventilation. However the total gas being used will still be displayed on the ventilator screen to facilitate calculation.

It should be appreciated that some other means of administering non-invasive modes of respiratory support require very high gas flows, making them fairly impractical for transport. For example the older 'whisperflow' machines used for administering CPAP may use as much as 140 litres of O_2 per minute. For a 15 minute transfer (taking enough for one hour) you might need 8400 litres of oxygen or over 6 size F cylinders!

Key Point:
Ensure the O_2 cylinders are full prior to work and that you have enough for twice the journey or as a minimum for one hour.

References & Further Reading ▼

Introduction to Medical Gases (2009) Anaesthesia UK
http://www.frca.co.uk/article.aspx?articleid=100154

Chapter 9 - Are you ready for departure? ▾

■ LEARNING OUTCOMES

At the end of this chapter the reader should be able to

- Review the final checks that should be made of the patient, equipment, drugs and accompanying staff
- Understand the documentation and communication that must be made before coming to a final decision to transfer the patient

The Patient ▼

This is the time to undertake a review of the patient's physiology. Are the airway, breathing and circulation still stable and acceptable?

The patient should be transferred and secured carefully on the transfer trolley, and adequately wrapped to prevent heat loss. The patient should be appropriately monitored on the transport monitor and stable on the transport ventilator, with adequate gas exchange confirmed on an arterial blood gas. The monitor and ventilator should be securely stowed and should not rest upon the patient. Ensure that the air inlet of the ventilator is not obstructed.

The ventilated patient should usually be adequately sedated and paralysed before transfer. Ready access to both the arterial line and a venous port for administering drugs should be ensured.

Have the receiving team requested any particular investigations or treatments prior to transfer. If so, have these been done?

The Transfer Team ▼

Who is going to accompany the patient? At least two members of staff must travel, one of which should be a doctor, and the other a nurse, operating department practitioner or similar. All must have the necessary competencies and be experienced to deal with any crises that may arise, including airway problems during the journey. They should be familiar with the patient and with the transfer equipment that is being used.

A detailed Risk Assessment (Appendix 1) should be undertaken by an experienced clinician in order to determine the level of competency required by the transferring staff. This risk assessment should take into account the following:

- Patient's current clinical condition
- Specific risks related to the patient's condition
- Risks related to movement / transfer
- Likelihood of deterioration during transfer
- Potential for requiring additional monitoring / intervention
- Duration and mode of transfer

The ambulance service is not necessarily obliged to return the transferring staff and their equipment back to the referring hospital. This should be clarified in advance, and alternative arrangements made for the return journey if necessary. Staff should have some means of funding this return journey if required.

The transport environment is cold, and staff must ensure that they are adequately dressed in warm, high visibility clothing.

Transport services are not immune to being involved in accidents themselves. Staff should therefore wear seatbelts during the journey. If anything other than the simplest of clinical intervention is required during the journey, the ambulance should be stopped safely before the patient is attended to. Staff must also make sure that they are insured in the event of an accident outside the confines of the hospital.

Drugs and Equipment ▼

The number of infusions should have been reduced to an essential minimum. These should be positioned ideally at the level of the patient or below, and should contain sufficient drug for double the transfer or at least an hour without needing to change the syringes.

All equipment including infusion pumps, monitors, and ventilator should be fully charged. They should be plugged into the mains until the moment of departure, and should be plugged into the ambulance power supply during the journey where this is available.

Any other routine and emergency drugs that may be required during the transfer should be prepared and checked. These will depend on the nature of the patient, but may include boluses of muscle relaxant, atropine, adrenaline, mannitol, vasopressors such as metaraminol etc.

A calculation of the amount of oxygen required for the journey should be made, and the appropriate cylinders obtained. The cylinders should be full, and should have an appropriate regulator attached. For example a Schrader valve for use with the transport ventilator. A means of ventilating the patient in the event of a ventilator or oxygen failure, such as a self-inflating bag must be carried.

A transfer bag containing the standardised equipment for transfers within the WYCCODN (Appendix 3) and any other equipment that may potentially be needed should be prepared. The contents of the bag must be checked and replenished after every use. The transferring team must be familiar with the contents and know where to locate equipment in an emergency.

Documentation ▼

The reasons for transfer must be clearly documented in the notes, as should the name of the receiving consultant. Any discussions with the patient and family must be noted.

The case notes, or a photocopy of these, plus all recent blood results, X-rays, microbiology results etc. must accompany the patient. A transfer letter documenting a concise summary of the patient's history to date, current level of support, and on-going problems will be invaluable to the receiving team.

The transfer form (Appendix 4) on which patient observations during the journey will be recorded should be prepared and the pre transfer checklist completed (see page 17).

Communication ▼

Communication is discussed to a greater extent in the following chapter however in summary:

- The patient where possible and their family must be informed of the transfer and the reasons for it. A Critical Care Transfer leaflet is available for patients and relatives, and can be downloaded from the WYCCODN website from the Network. www.wyccn.org
- Communication must take place with the receiving doctor to confirm acceptance and that a bed is still available. Nursing and medical staff should also liaise with the receiving unit regarding the patient's level of support and on-going problems, so that appropriate preparations may be made. The receiving unit should be contacted on departure and an estimated time of arrival given.
- The ambulance service must be contacted to arrange an ambulance with appropriate equipment and trained crew. The urgency of the transfer must be made clear when arranging this transport.
- The transferring staff should have some means of communicating with the base and receiving units. A charged mobile phone is essential with contact numbers for both units readily available.

Chapter 10 - Communication ▾

■ LEARNING OUTCOMES

At the end of this chapter the reader should be able to

- Understand the importance of effective communication throughout the transfer process
- Provide a concise handover using the SBAR model
- Order the appropriate ambulance for the patient
- Complete the appropriate documentation

Sub optimal communication between healthcare professionals is widely recognised as a significant causative factor in incidents compromising patient safety and potential complaints. Communication regarding the transfer of critically ill patients is by no means an exception. Indeed, the opportunity for failure is potentially increased as individuals are required to communicate with a number of professionals of varied disciplines who are geographically separated.

It is essential therefore that effective communication is maintained throughout the entire transfer process with various methods adopted. While initial verbal discussions will be held face to face at the referring unit, much of the transfer process will later rely on effective telephone communication, supported with accurate and legible record keeping.

The transfer process is the joint responsibility of the referring and receiving clinicians. The main forms of communication we use are verbal and written. Many of the principles of good communication apply to both, but it is worth noting that bad handwriting can be a major obstacle to good communication. When completing transfer documentation ensure your handwriting is legible.

The quality of communication between the referring and receiving hospital and, the referring hospital and Ambulance Control can be enhanced by using a structured communication technique, such as the SBAR model shown on next page (Institute for Innovation and Improvement).

Situation	Confirm patient identity Diagnosis Reason for transfer Medical plan Is patient aware of transfer
Background	Summary of patient inc. PMH , Date of admission, operations, medications , allergies , relevant investion results
Assessment	Clinical information Vital Signs
Recommendation	Advice about what to do next Timeframe of transfer

Using a recognised structure like SBAR means that both the speaker and listener know what to expect. It helps to ensure that the speaker does not miss out any key communication. In addition the listener is able to assimilate the information more easily.

Finding a bed ▼

The availability of beds within the Network can be checked using the Critical Care Directory of Services (DoS). This is a national bed availability database which all critical care units are required to update as a minimum twice daily - 08:00 and 20:00. The system provides an overview of available level 2/3 beds by unit across Operational Delivery Networks. The system can be accessed at https://www.directoryofservices.nhs.uk/. Each critical care unit has an individual login code and password.

This is applicable to adult and paediatric critical care beds.

Prior to transfer ▼

It is essential that the decision to transfer a patient is agreed between senior clinicians at the referring and receiving hospitals, and that an appropriate critical care bed is available to meet the patients' requirements. If the patient is being transferred for specialist care such as neurosurgery or liver transplant, then this transfer must also be agreed by the relevant consultant in that speciality.

A parent team at the receiving hospital should also agree to take over care of the patient.

Where patients are transferred for non-clinical reasons such as bed shortages, the parent team responsible for the patient must be informed and they are required to handover responsibility for the patient to an appropriate team at the receiving hospital.

Prior to transfer verbal communication between medical and nursing staff in the referring and receiving units should take place. This gives the receiving unit the opportunity to ensure that any preparations are made to take over the patient's care. They should be contacted again immediately before departure to ensure the bed is still available and to give an approximate time of arrival.

The patient's case notes should either travel with them or be photocopied along with relevant investigation results. A transfer letter should be prepared summarising the patient history, events, levels of support and on-going problems.

The patient and their next of kin must be informed of the transfer and the reasons behind it. If you cannot get in touch with them, frequently retry and document that you have each time. Ensure they have direct telephone number of receiving unit and if possible the name of a member of staff to speak with. The provision of directions to the hospital, which can be found on the hospitals internet page, will be helpful to them. It is vital that the family are instructed NOT to attempt to follow the ambulance for health and safety reasons. A Critical Care transfer leaflet is available for patients and relatives from the WYCCNODN website, www.wyccn.org.

If the transferring team have not previously been involved in the care of the patient, then a formal handover of information must occur prior to transfer.

Don't forget to tell your colleagues that your patient is being transferred. They may be able to lend a hand. Delegating tasks to other members of staff will make the preparation easier.

Arranging the Ambulance ▼

The National Framework for Inter-Facility Transfers (IFT) published by the Association of Ambulance Chief Executives in 2018 describes four levels of priority for inter-facility transfer based on clinical need and urgency. Based on this Yorkshire Ambulance Service have produced Ambulance Transfer Booking Guidance as shown below:

NHS Yorkshire Ambulance Service NHS Trust

Ambulance Transfer Booking Guidance v1

0300 330 0276

Do you need our clinical help right now to deliver an immediate life- saving intervention / or are you declaring an obstetric emergency? Press 1 for yes or hold for an operator	**For example:** Cardiac Arrest, anaphylaxis, birth units declaring obstetric emergency, life threatening asthma in an UTC	Yes → **Category 1** Call processed as emergency. Mean response 7 minutes. Nearest resource will be dispatched
No ↓ **Is there a need for an immediate intervention that cannot be carried out at the current facility and the patient is at immediate risk of death or life changing loss of a limb or sight?**	**For example:** Immediate neurosurgery, PPCI, Thrombectomy, immediate limb or lifesaving surgery	Yes → **Category 2** Mean response 18 minutes. Closest emergency ambulance dispatched
No ↓ **Does the patient require additional clinical management upon arrival at the new facility?**	**For example:** Non immediate surgery, creating a critical care bed, mental health crisis.	Yes → **Category 3** Response within 1 hour
No ↓ Transport for on-going care but do not need to be managed as an emergency transfer	**For example:** Critical Care repatriation	Yes → **Category 4** Response within 4 hours

Key elements of the IFT agreement are:

- **Category 1** is not appropriate for Inter-hospital transfer
- **Category 2** is appropriate only where immediate life-saving or time critical intervention is required. (E.g. acute neurosurgical transfer, PPCI). The closest emergency ambulance will be dispatched. Ensure the patient is on the transfer trolley, ready for transfer and with transferring team in place
- **Category 3** is appropriate for most critical care transfers. This includes non-clinical transfers (due to lack of critical care bed) and transfers out to create critical care capacity for another patient
- **Category 4** is appropriate for repatriations

When a bed at the receiving hospital is confirmed and you require transfer within the hour, transfer the patient onto the critical care transfer trolley. Establish the monitoring and ventilation and ensure the patient is stable for transfer. When the pre transfer checklist is completed and the patient is fully ready to go, telephone YAS and state that you require a critical care transfer using the bariatric or critical care transfer trolley and the priority of the patient according to the YAS inter-facility guidance. Give YAS full details of patient, main diagnosis, equipment, accompanying personnel, receiving hospital, department and oxygen requirements. A non-urgent critical care transfer allows more time for you to prepare your patient and move onto the transfer trolley.

Transfers using other ambulance services will differ. Those units using a different ambulance service should keep updated information on how to organise an ambulance from them.

■ Special Circumstances / Bariatric patients

Where there are special circumstances these should be notified to YAS at the time of requesting an ambulance.

Bariatric patients being transferred on a bariatric trolley for example require a specialist vehicle with central trolley mounting (as opposed to the standard side mounting). There are only a limited number of these in the YAS fleet and this may delay the transfer.

During the Journey ▼

It is essential that the transfer team is able to contact either the referring or receiving units during the transfer if necessary. A mobile phone should be available for this purpose. Contact telephone numbers for all the units within WYCCODN are on the transfer form (appendix 4). During the transfer a record should be made of all appropriate observations at a frequency determined by clinical need, but at a minimum frequency of every 15 minutes. All drugs and fluid given and any other actions or incidents must be documented on the transfer form (appendix 4).

On Arrival ▼

On arrival at the receiving unit a formal handover between both medical and nursing staff must occur. This handover should be both written and verbal. Appendix 5 contains the Handover Information Sheet to be used for transfer handovers with WYCCODN. Until this handover has taken place, the patient remains the responsibility of the transferring team.

Any critical incidents that occur during transfer should be recorded on the transfer form and your local trust critical incident reporting process followed.

After completing a critical care transfer please return the middle copy of the transfer form to WYCCODN for audit purposes.

Monitoring of the number of transfers, identifying difficulties and critical incidents is a mandatory requirement from NHS England. It facilitates the development of the service and the investigation of potential critical incidents.

Lastly, don't forget to communicate how you will be returning back to base. For the majority of the time the ambulance crew will have to return the transfer trolley back to the referring hospital, but just in case this doesn't happen it's always a good idea to have a mobile phone, some money and a warm coat with you.

■ Problems / Incidents

Transfer of critically ill patients is not without risk and occasionally things will not go as well as expected. Critical Incidents should be recorded on the transfer form, in the patients medical records and via your local incident process. Problems with ambulance bookings or critical incidents involving YAS should also be reported to yas.patientrelations@nhs.net. WYCCODN Transfer Guidelines (2021) include a feedback and escalation process flowchart to promote transparency and learning from critical incidents relating to patient transfers.

References & Further Reading ▼

Adult Critical Care Transfer Guidelines (2021) West Yorkshire Critical Care & Major Trauma ODN. Available at www.wyccn.org

SBAR Tool. Institute for Innovation and Improvement. www.ihi.org

Association of Ambulance Chief Executives (2018) National framework for Inter-facility transfers

Chapter 11 - Human Factors ▼

At the end of this chapter the reader should be able to

- Understand the basic principles of Human Factors and their application to critical care transfers

What are Human Factors? ▼

Human factors encompass all those factors that can influence people and their behaviour. In a work context, human factors are the environmental, organisational and job factors, and individual characteristics which influence behaviour at work.

A widely accepted definition of human factors has been provided by the International Ergonomics Association Council:

'Ergonomics (or human factors) is the scientific discipline concerned with understanding of interactions among humans and other elements of a system and the profession that applies theory, principles, data and methods to design in order to optimise human well-being and overall system performance.'

(Russ et al, 2013)

Human factors help complement things that interact with people in terms of people's needs, abilities and limitations.

The science of human factors has grown out of the high risk aviation industry, in recent years the approaches taken to manage risk have been adopted by the health sector.

How errors and incidents occur? ▼

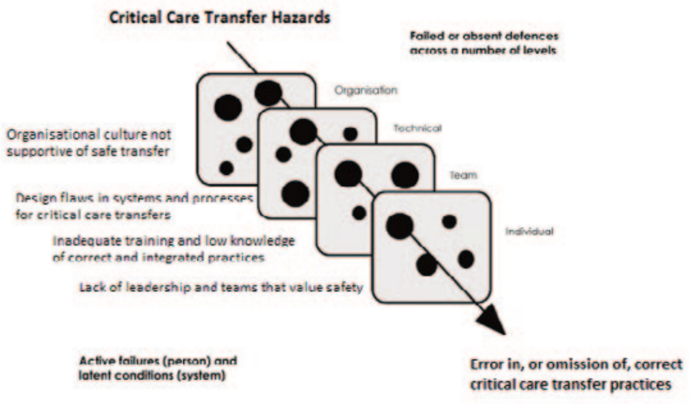
Healthcare professionals like all humans are fallible. During working lives we all make mistakes in the things we do, or forget to do, but the impact of these is often non-existent, minor or merely creates inconvenience. However, in healthcare there is always the underlying chance that the consequences could be catastrophic. It is this awareness that often prevents such incidents as we purposefully heighten our attention and vigilance when we encounter situations or tasks perceived to be risky.

A fundamental principle of human factors thinking is that human error is not absolutely preventable and systems need to be designed that are resilient when human errors occur. Systems in healthcare must be designed with the capability to prevent errors occurring, mitigate the harm of any error that cannot be prevented, and recognise the occurrence of errors such that actual harm to patients can be prevented – so error does not lead to catastrophe.

One of the most well-known illustrations of this thinking in healthcare is the Swiss Cheese Model of Organisational Accidents (Reason 1990). The Swiss Cheese Model assumes that in any system there are many levels of defence. Examples of levels of defence would be checking of drugs before a critical care transfer or the completion of a pre transfer checklist. Each of these levels of defence has little 'holes' in it which are caused by poor design, senior management decision-making, procedures, lack of training, limited resources etc. These holes are known as 'latent conditions'. If latent conditions become aligned over successive levels of defence they create a window of opportunity for a patient safety incident to occur. Latent conditions also increase the likelihood that healthcare professionals will make 'active errors.' That is to say, errors that occur whilst delivering patient care. When a combination of latent conditions and active errors causes all levels of defences to be breached a patient safety incident occurs. This is depicted by the arrow breaching all levels of defence in Figure 1.

When such incidents occur it is uncommon for any single action or 'failure' to be wholly responsible. It is far more likely that a series of seemingly minor events all happen consecutively and/or concurrently so on that one day, at that one time, all the 'holes' line up and a serious event results.

Figure 1. Cheese Model of Organisational Accidents



On investigation it becomes clear that multiple failings occur and the outcome appears inevitable, but for those working in the system it can be shocking as they have often worked with these same environmental conditions and small errors or slips occurring regularly without harm ever occurring as a result. It is very rare for staff in healthcare to go to work with the intention of causing harm or failing to do the right thing. Therefore we have to ask why there are many incidents where some of the latent conditions are caused by staff not doing the right thing, even when they know what the right thing is. Many processes and policies in healthcare are complex or seem to create difficulties for busy staff thus creating the temptation to take shortcuts.

Developing a Safety Culture ▼

Much has been written about the need for healthcare organisations to create a positive safety culture (Department of Health 2000; 2001; National Patient Safety Agency 2004; Reason, 2000) and human factors research has shown that senior management commitment is core to its development (Pidgeon, 1991; Reason, 2000; Mearns et al., 2003; Flin et al., 2004; Waring, 1996). Mitigating risk is the responsibility of both organisations and individuals.

Element of safety culture	Characteristic
Open culture	Staff feel comfortable discussing patient safety incidents and raising safety issues with both colleagues and senior managers
Just culture	Staff, patients and carers are treated fairly, with empathy and consideration when they have been involved in a patient safety incident or have raised a safety issue
Reporting culture	Staff have confidence in the local incident reporting system and use it to notify healthcare managers of incidents that are occurring, including near misses • Barriers to incident reporting have been identified and removed: - staff are not blamed and punished when they report incidents - they receive constructive feedback after submitting an incident report - the reporting process itself is easy
Learning culture	The organisation: - is committed to learn safety lessons - communicates them to colleagues - remembers them over time
Informed culture	The organisation has learnt from past experience and has the ability to identify and mitigate future incidents because it: - learns from events that have already happened (for example, incident reports and investigations)

(Patient Safety First, 2010)

Individual responsibilities ▼

Expertise, competence and hard work do not always safeguard against errors and omissions that result in harm. There are times when we can clearly see how a particular action results in an incident or near miss but often our actions merely breach layers of defence, creating unseen conditions of increased risk.

The first step is accepting that we all make mistakes or forget things regardless of our experience, technical ability or seniority. It may be as simple as forgetting to contact the receiving unit before departure, or catastrophic, such as not checking you have sufficient drugs or oxygen supply to safely manage a patient during the length of a transfer. Every one of us is human and that means we are never 100% perfect, 100% of the time.

The following table provides a list of factors that are known to contribute to patient safety incidents and possible methods of mitigating risk.

Factor	Characteristic
Cognition and mental workload	There are a number of factors that influence an individual's ability to perform and are linked to patient safety. • Stress - may be the result of personal factors or due to pressure exerted by our workload or an emergency situation. No matter the cause the results can lead to a lack of focus or concentration, or becoming overly focused on details at the expense of the wider context. • Self-awareness - If feeling stressed and having difficulty concentrating consider your-self at a greater risk of making a mistake. Focus on the high risk tasks such as drug preparation prior to transfer and ensure checking procedures are rigorously followed. • Emergency situations - Follow recognised algorithms e.g. Resuscitation guidelines; Difficult intubation guidelines • Reliance on vigilance and memory - When you have a large number of tasks or things to remember making lists and using checklists can be a helpful prompt or a reassuring check that you have done everything you needed to.
Distractions	Distractions are accepted as inevitable in busy health environments. Where possible noise levels and interruptions should be minimised.
The physical environment	It is recognised that physical environment can influence safety. When undertaking critical care transfers staff are working in a strange environment with limited space. Therefore it is suggested that staff: • Familiarise beforehand the layout of an ambulance • Only take equipment required to reduce clutter
Physical demands	Demands exceeding capability : Most people at some time or another overestimate their abilities or underestimate their limitations. This may be in terms of technical skill, physical capability or ability to manage a particular workload or number of tasks. • Staff should be encouraged to regularly seek out constructive feedback • Encourage others to speak out if they feel something might not be right. Physical tiredness: • Mistakes are more prevalent when individuals are tired • Fatigue results in slower reactions, reduced ability to process information, memory lapses, absent-mindedness, decreased awareness, lack of attention, underestimation of risk, reduced coordination etc.
Service/product design	Healthcare equipment is often not designed with human cognitive limitations in mind. Design creates error traps and is a frequent cause of patient safety incidents. Healthcare organisations also use large numbers of different medical devices which increases the risk that staff will make errors resulting from applying their understanding of how one device functions to another device. To mitigate this risk standardisation of equipment is advocated. For example: • Standardised transfer trolley • Standardised equipment list for transfer bag contents

Factor	Characteristic
Teamwork	Multiple patient handovers, hierarchy, cultures that discourage challenge and stress responses can all contribute to poor outcomes. Furthermore, where team members do not feel that they can speak up and be listened to if a situation is unsafe there is an increased risk of patient harm. Approaches to improve safety are: • Briefing and debriefing • Safety Checklist (ESCORT Transfer checklist) • Communication tools such as SBAR (Situation, Background, Assessment, Recommendation) • Transfer Handover Document • Network Transfer Form
Process design	Process design Where healthcare processes are designed so that they involve complex task sequences there is an increased risk that critical safety steps will be omitted. It is important to ensure that clinical processes are simplified to reduce the potentially negative impact of memory limitations on human performance.

It is evident that many of the components of Human Factor theory can be translated and used in practices of safe transfer of the critically ill. It is clear that improving patient safety ultimately requires a collaboration between staff at all levels within organisations. It is also acknowledged that changes are well within the ability of a committed team of staff and where they are not, the role of an organisation's leaders in empowering and supporting them is crucial.

Being willing to share experiences with colleagues can help to create an environment that is more open about errors and begin to break down the myth that making mistakes or having near misses is negative reflection on competence rather than normal human fallibility.

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Chapter 12 - Legal & Ethical Aspects of Patient Transfer ▼

■ LEARNING OUTCOMES

At the end of this chapter the reader should be able to

- Understanding the basic legal and ethical aspects of transferring critically ill patients.

Legal Issues ▼

When considering patient transfer it should be recognised that it is a procedure with risks for a critically ill patient that are hopefully outweighed by benefits. If the reason for transfer is obviously to provide better care for a patient, even if it is because of lack of availability of beds, then legally the principles that apply are similar to any other treatment.

If a patient is conscious and deemed competent then it may be possible to discuss the implications of the transfer with them, and to seek consent. If the patient is not awake then it would be good practice to seek assent from the relatives before transfer. Generally, discussion with the relatives is not likely to affect the transfer decision however there are situations where relatives input could be useful. For example if a patent is being transferred to be closer to home the relatives may indicate that there would be better family support going to an area closer to another relative. It might be that a patient has previously expressed a strong desire not to be admitted to a certain hospital. If that were the case then arranging such a transfer would be the same as performing it without consent, with all the coincident ramifications.

Some critically ill patient transfers may have to be arranged when they are not in the individual patient's best interests. Such transfers may even be routinely planned. Examples of this can include, repatriation from a tertiary unit to a district general hospital, or transfer of a patient out of intensive care to another unit because of bed pressures. The status of a transfer that is not in the patient's best interests is questionable but would only be clarified if a case were taken to court. When a patient is awake then their consent could be sought and obtained.

The problem with this approach is that it implies that failure to achieve consent would mean the patient is not transferred. The status of relative assent in this situation is even more tenuous. There seems little point in seeking approval to transfer unless it is accepted that failure to achieve approval would be honoured.

Clinicians have a responsibility to keep good quality, contemporaneous, records. This includes detailed vital signs information. Ideally this data will be stored electronically. On occasion it can be difficult keeping a record exactly at the time of an event, in which case creating a record as close in time to the event as possible is helpful as long as it is clear when the event occurred and when the record is made. There is no agreed acceptable frequency of observations for a patient being transferred. In the operating room most anaesthetists record vital signs every 5 minutes whereas most critical care nurses would update a paper record once an hour. In the case of the critical care unit it is understood that patients are being monitored continuously and any significant variation between hourly readings would be noted on the chart. Such an assumption would not be made once the patient leaves the unit on a transfer. Ideally patients during transfer should have vital signs recorded at least every 5 minutes, preferably automatically as explained above. If this is not possible then the vital signs data should be supplemented by relevant text based explanations such as 'patient stable throughout' or ' oxygenation maintained within the range of 88-94%' etc.

Clinicians have a duty of care to be sure that patients are only transferred for good reason. If a patient is transferred to and from another place for an assessment or procedure that is not performed or needed; or if it would have been more reasonable for the assessor or procedure to have travelled to the patient rather than the other way round, then this would be a breach in duty of care. Such breaches should be internally investigated and responsibilities under the duty of candour recognised.

Ethical Issues ▼

The relative shortage of intensive care beds in the UK means that patient transfer can raise a number of complicated ethical questions. The reason for this is that the needs of the individual may need to be balanced with needs of others. This is unusual for clinicians used to considering an individual's needs are paramount.

There is frequently no clear right or wrong answer to ethical questions. The answer that is least likely to result in legal problems is not necessarily the best ethically. An understanding of basic ethical principles together with a good process for decision making is the best way to protect the patients and clinicians involved. All clinical staff will be aware of, and understand the need to respect a patient's right to self-determination, to offer treatment whose aim is to do good and to avoid harm. It is the ethical concept of being 'just' or 'fair', when balancing the needs of one group against another, that creates most dilemmas.

It is important to realise that often it is not as simple as asking if a decision is ethical or not. For example a situation might arise where a decision is being contemplated to transfer a critically ill but stable patient from one unit to another to make way for a very unstable patient needing immediate transfer in. It might be suggested that it is unethical to transfer the stable patient as it is not in their best interests. This would be a clear breach of the principle of 'do no harm' from the point of the stable patient, so on the face of it would not be ethically sound. From the unstable patient's point of view it might not be feasible to transfer them at all, or the transfer could be very high risk when not absolutely necessary. Putting them at this extra risk could be considered unethical from their point of view. Usually it will be the principle of doing the most good for most people that should win over the argument, while always accepting an unnecessary transfer is a last resort.

What about the decision making process?

It is vital that those making decisions are fully informed and experienced enough to make a proper, considered and balanced decision. It has been explained that erroneous consideration of a simple ethical principle from one point of view could colour a decision in such a way that the wrong choice overall is made. Ethical decisions relating to patient transfer must be taken at a senior level and should not be delegated to those in training. Whatever the seniority there is always the risk that one individual will fail to see all the implications of their decision. Such a problem can be alleviated by conferring with the multidisciplinary team to make sure that any obvious objection is given due consideration. Achieving consensus within the multidisciplinary team, as long as all are free to express their view, will increase the likelihood of a 'good' decision being made. If it is not possible for the team to agree, then colleagues can be consulted and the decision taken higher up in the organisation. It is important that the seriousness of this sort of debate is recognised.

So what are the answers to the questions about:-

- Transferring out a stable patient to make way for an unstable one?
- Transferring a patient in their best interests when their next of kin does not agree?
- Transfer of a patient for tertiary care when there is reason to believe the patient would not have wished to receive this care, such as a well-documented suicide attempt?

Such questions can only be answered when considering not only the individuals directly involved but also any others that would be affected by the decision. It is possible to involve the courts in an impasse but taking this approach is never easy. It is worthwhile remembering that although the court interprets the law they will ultimately have to rely upon clinical advisors. Reverting to the court should not be used as a way of sidestepping a difficult decision.

Decisions may later be challenged and if so this could be from the point of view of any of those involved. Generally being open and fair, consulting with colleagues and relatives and not being afraid to seek additional help will result in the 'best' decision being made.

References & Further Reading

Beauchamp, T. and Childress, F. (2001) Principals of Biomedical Ethics. Oxford: OUP

Chapter 13 - Specialist Transfers: The Head Injured Patient ▼

■ LEARNING OUTCOMES

At the end of this chapter the reader should be able to

- Understand the special considerations that need to be taken when transferring patients with head injuries

Head injuries are extremely common, with many patients requiring urgent neurosurgical attention. Many of these patients are now being transferred by paramedics directly into an appropriate Major Trauma Centre such as Leeds General Infirmary. However a proportion of these patients will present to hospitals that do not provide neurosurgical care, and therefore will need to be transferred to a Major Trauma Centre, often some distance away.

Transfer of patients with head injuries is potentially hazardous. Patient may commonly have other injuries that may demand attention and stabilisation prior to transfer. If meticulous attention to detail is not paid then the patient's head injury may be made significantly worse during transfer, with detriment to outcome.

Primary brain injury describes the insult which occurs at the moment of impact. Examples of this form of insult include brain laceration, brain contusion, and diffuse axonal injury. This primary insult cannot be 'undone' once it has occurred. The patient's GCS at the scene may give a measure of the severity of this primary injury.

Following primary brain injury there are many subsequent insults which may exacerbate the original injury and worsen outcome. These insults are described as secondary brain injury, and include the following:

- Hypotension
- Hypoxia
- Hypercapnia
- Excessive hypocapnia
- Hyperthermia
- Hyperglycaemia
- Cerebral oedema
- Seizures
- Haemorrhage such as intracerebral, subdural, and extradural

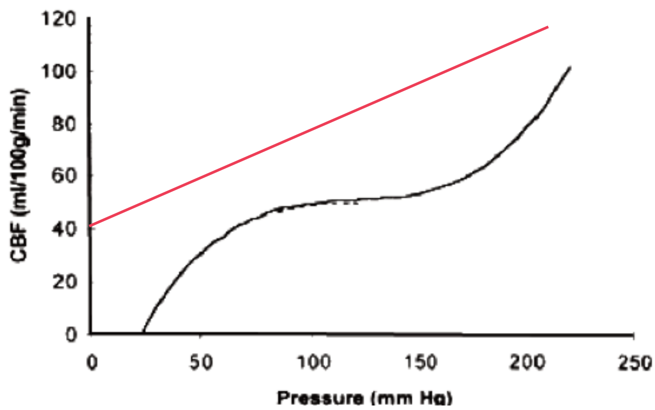
Many of these phenomena are potentially avoidable or treatable. The first four are particularly relevant to the transfer setting, and due attention must be paid to avoiding them.

In order to understand why these insults exacerbate brain injury, we need to understand normal cerebral physiology.

Cerebral Physiology ▼

■ Cerebral Blood Flow

Normal cerebral blood flow (CBF) is around 50 mls/100g tissue/minute, or roughly 750 mls/minute. This blood flow is remarkably constant over a range of blood pressures due to a process termed autoregulation. This is illustrated graphically below, the unbroken black curve representing the normal brain, exhibiting a constant blood flow between a mean arterial pressure of approximately 60 mmHg and 160 mmHg.



This is important as the brain requires a constant supply of oxygen and glucose, without which cell death will occur after a matter of minutes. The brain is a very unforgiving organ. Autoregulation ensures a constant supply of these substrates in the face of blood pressure fluctuations.

The injured brain unfortunately no longer exhibits autoregulation and blood flow becomes **pressure dependent.** The red line on the graph above illustrates this. This results in a cerebral blood flow that will drop if hypotension occurs, leading to cerebral hypoxia.

In addition to this, blood pressure must be higher than normal to ensure good cerebral perfusion, as any degree of raised intracranial pressure must be overcome.

In head injury, cerebral blood flow becomes governed by the Cerebral Perfusion Pressure or CPP. This pressure is equal to the mean arterial pressure (MAP) minus the intracerebral pressure (ICP).

CPP = MAP - ICP

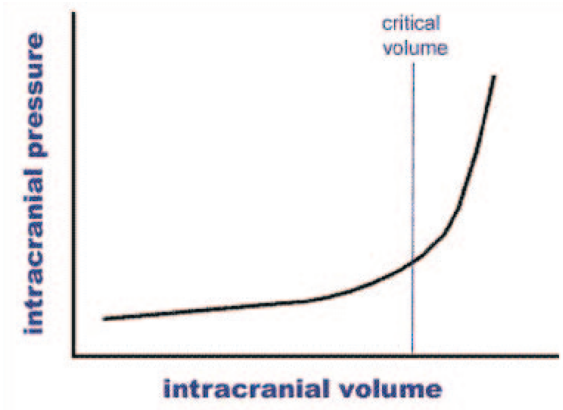
The normal ICP is 5-15 mmHg. In head injuries this pressure may become elevated. Clearly, we do not know the exact ICP without measuring it, but in head-injured patients with depressed conscious level, the ICP should be assumed to be elevated at > 20 mmHg. Measures should be taken to minimise any rise in ICP and these will be discussed below.

There is some evidence to suggest that CPP should be maintained at a minimum of 60 mmHg. This will therefore require a MAP of > 80 mmHg.

■ Intracranial Pressure

The skull is essentially a fixed box containing brain, cerebrospinal fluid (CSF), and blood (within blood vessels). There is very little room for anything extra, or any expansion of any of these components. This is known as the **Monroe-Kellie Doctrine.**

Any expansion within the skull will be accommodated initially by for example squashing the ventricles and thereby reducing the volume of CSF within the skull. These compensatory mechanisms are quickly exhausted and any further expansion will result in a sharp rise in ICP. This is illustrated top right.



The only way this rise in pressure may be dissipated is by forcing the brain downwards through the foramen magnum. This will ultimately result in coning and brain stem death, and may be heralded by

- Falling conscious level
- Bradycardia and hypertension (The Cushing Reflex)
- Cheyne-Stokes respiration in the spontaneously breathing patient
- Dilating pupils (third nerve palsy due to compression against the tentorium cerebelli).

Minimising Intracranial Pressure ▼

It is essential when managing the patient with head injury that steps are taken to minimise ICP, to avoid further brain damage and in a worst case scenario, coning and brain stem death.

This may be achieved by:

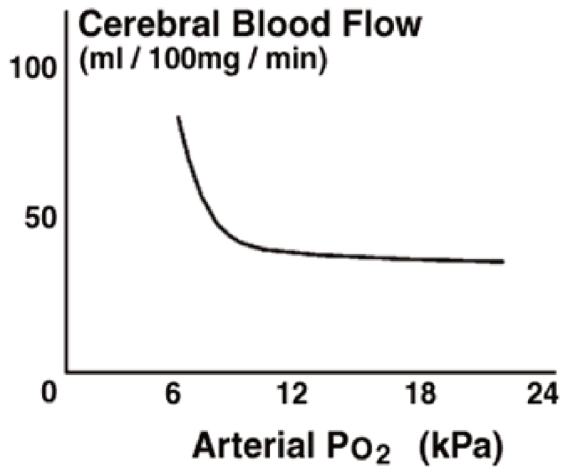
- Minimising brain tissue volume
- Minimising cerebral blood volume
- Minimising CSF volume
- Evacuating anything that shouldn't be there (e.g. Haematoma)

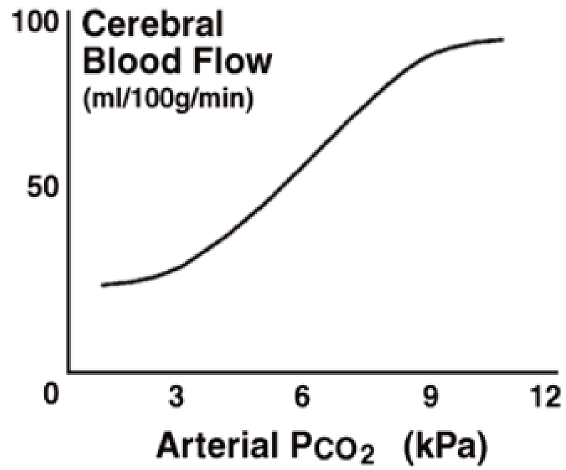
We have some influence on the first of these by administering Mannitol, and most control over the second. The third and fourth are the domain of the neurosurgeons.

Minimising brain tissue volume This may be achieved by administration of a Mannitol bolus. This drug is often given under the direction of the neurosurgeons prior to transfer depending on the results of a CT head, but should also be considered where there are signs of critically elevated ICP as listed above.

Minimising cerebral blood volume This may be achieved by avoiding vasodilatation, by ensuring good venous drainage, and minimising intrathoracic pressures.

Avoiding vasodilatation - Both hypoxia and hypercarbia cause marked cerebral vasodilatation. This is illustrated below.





It can be seen that cerebral blood flow will increase sharply below a PaO_2 of 7 kPa. Cerebral blood flow also varies directly with $PaCO_2$ between values of around 2 and 10 kPa.

Therefore in head injury, hypoxia must be avoided and ideally a PaO_2 of at least 13 kPa achieved. A $PaCO_2$ at the low end of normal should be targeted. i.e. 4.5-5.0 kPa. Where there are signs of incipient coning as described above, $PaCO_2$ may be transiently dropped further by increasing ventilation to 4-4.5 kPa, but this may potentially cause brain ischaemia due to excessive vasoconstriction.

- Ensuring good venous drainage - This may be achieved by simple manoeuvres such as positioning the patient with a head up tilt, and the head in a neutral position. Jugular venous lines and ties around the neck should be avoided. Endotracheal tubes should be taped not tied.

- Minimising intrathoracic pressure - This may be achieved by careful choice of ventilator parameters, avoidance of excessive PEEP, adequate sedation and paralysis to avoid any coughing and straining on the endotracheal tube.

Pre-transfer stabilisation of the brain-injured patient ▼

Having outlined the physiological principles we must now look at how this should be applied to the transfer situation. In addition to our usual goals we must endeavour to avoid secondary brain injury and provide a constant supply of oxygenated blood under adequate pressure to a slack brain.

Do not forget that the head-injured patient may well have sustained other injuries, and a full ATLS style primary and secondary survey should be undertaken. Airway, breathing and circulation must always be attended to first, before the head injury. There is no sense in setting off with a patient who is persistently hypotensive due to intra-abdominal bleeding; a laparotomy may be required first.

However, it is also important that the patient is resuscitated and stabilised without unnecessary delay. If a patient has an expanding intracranial haematoma such as an extradural, neurological outcome will be improved if that clot is removed sooner rather than later, and ideally within four hours.

A - Airway

As with all patients the airway must be patent and protected. Indications for intubation after head injury include the following:

- GCS of < 9 or less
- A GCS falling by 2 or more points particularly if these points are motor
- Hypoxia (PaO_2 < 13 kPa)
- Hypercarbia ($PaCO_2$ > 6 kPa)
- Spontaneous hyperventilation ($PaCO_2$ < 4.0 kPa)
- Seizures
- Copious bleeding into the mouth (e.g. from base of skull fracture)
- Bilateral fractured mandible

If in doubt the patient should be intubated. Secure the endotracheal tube with tape rather than ties

B - Breathing

The intubated patient must be stabilised on the transport ventilator. Hand ventilation is unacceptable. Blood gases should be checked and demonstrate a PaO_2 > 13 kPa and a $PaCO_2$ of 4.5-5.0 kPa.

End tidal CO_2 should be monitored with a capnograph. The end tidal CO_2 is generally O.5 kPa lower than the arterial $PaCO_2$, and so an end tidal CO_2 of 4.0-4.5 kPa should be targeted.

Chest drains should be inserted if indicated e.g. for pneumothoraces or heamothoraces. Patients with rib fractures who are ventilated should have chest drains inserted even if no pneumothorax is evident.

C - Circulation

At least two sites of wide-bore peripheral venous access should be secured. The patient must be fluid resuscitated before transfer using appropriate clear fluids and blood products.

Dextrose containing solutions should be avoided as these may be associated with increased cerebral lactate levels and acidosis.

Haemorrhage should be controlled. This may occasionally necessitate surgical intervention such as a laparotomy or external fixation of the pelvis before the patient is stabilised. Long bone fractures should be splinted.

An arterial line should be used to monitor blood pressure continuously. A MAP of 80 mmHg should be targeted. If this is not achieved despite adequate volume resuscitation, and all other causes of hypotension have been ruled out, then central access and vasoactive drugs may be required to drive the cerebral perfusion pressure. The internal jugulars should be avoided for central access as this may impede cerebral venous drainage. The femoral vein may be the safest and easiest option in this situation.

D - Disability

The GCS prior to sedating and intubating should be documented. Once sedated, the only means of assessing the central nervous system will be by observing the pupils. This must be done regularly and documented.

Patients should be adequately sedated and paralysed for the journey. Coughing and straining should be avoided. The patient should be positioned with a 20 degree head up tilt with the head in a neutral position.

Any patient who has had a seizure should be loaded with phenytoin before transfer. Mannitol should be administered if this has been requested by the neurosurgeons, or if signs of critically raised intracranial pressure develop such as the Cushing reflex or a dilated pupil.

Cervical Spine

Up to 6% of patients with a severe head injury will also have a cervical spine injury. Until the cervical spine has been cleared by an experienced senior clinician by appropriate clinical and/or radiological examination, then the spine must remain immobilised with a hard collar, sand bags and tape or equivalent, and the patient should be log-rolled.

E - Exposure

The patient should be catheterised and the stomach drained with an orogastric tube. Nasogastric tubes should be avoided in case of a base of skull fracture.

Monitoring

The UK Intensive Care Society (2011) recommendations for monitoring suggest that the standard of care and monitoring during transport should be at least the equivalent of the standard at the unit you are leaving. The following monitoring is essential during critical care transfers:

- ECG
- Invasive blood pressure
- Oxygen saturation
- Capnography
- Ventilator pressures and settings,
- Oxygen supply and concentration
- Pupil size and reactivity
- Temperature

Final Checks ▼

A final review of the patient should be undertaken as described in chapter 9. Although the patient should be fully stabilised, the team should be constantly vigilant for possible complications due to other injuries.

The transfer team should be chosen appropriately and must be familiar with the patient. Drugs and equipment must be checked, and the ambulance organised. All documentation should be in order and appropriate communication with relatives and the receiving unit complete.

References & Further Reading ▼

Head Injury: assessment and early management. (updated 2019) National Institute for Clinical Excellence. CG176. www.nice.org.uk/guidence/cg176

Guidance On: the Transfer of The Critically Ill Adult (2019) Faculty of Intensive Care Medicine and Intensive Care Society. Available at www.ics.ac.uk

Guidelines: Safe transfer of the brain injured patient: trauma and stroke (2019) Association of Anaesthetists.

Chapter 14 - Modes of Transport ▼

■ LEARNING OUTCOMES

At the end of this chapter the reader should be able to

- Understand the different modes of transport for critical care transfers and the advantages and disadvantages of each.

Most transfers are undertaken by road in our region, but occasionally patients may be moved by helicopter or fixed wing aircraft. Each of these modes of transport has its own advantages and disadvantages and these will be outlined below.

The choice of mode of transport will be governed by a number of variables, including:

- The condition of the patient
- Urgency of the transfer
- Geography
- The distance to be travelled
- Availability of vehicles or aircraft and their mobilisation times
- Staff training and experience
- Weather conditions
- Cost

Road Transport ▼

The majority of inter-hospital transfers occur by road in the United Kingdom. The advantages of this mode of transport are that it is relatively familiar to hospital staff and is a somewhat less hostile environment compared with aeromedical transport. The ambulances in use are purpose-built to transport patients, carry basic equipment and oxygen, and are manned by trained personnel. There are very few weather restrictions to road travel and ambulances can generally transport patients door-to-door. Compared to aeromedical transport, road travel is relatively cheap and rapidly mobilised.

The main disadvantage to road transfer is that it can be extremely slow over longer distances and may be subject to constraints due to heavy traffic. Patients will be subjected to the effects of acceleration and deceleration as the vehicle repeatedly changes its speed and direction. Motion sickness is not uncommon and may affect both patients and staff. Access may be difficult over rough terrain.

Despite being purpose built, the ambulance environment remains challenging to staff caring for a critically ill patient. The transfer trolley has a fixed position within the vehicle with 3 seats available for transferring staff, one at the patient's head and two at the side, parallel to the patient.

The seat at the head of the patient does not allow visual access to the patient monitor or infusions and we would recommend that staff sit in the seats parallel with the patient. Staff should remain seated at all times and wear the seat belts provided. Adequately resuscitated and stabilised patients should not normally require any significant changes to treatment during transport. If, however, 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 before administering treatment.

All equipment (including transfer bags) must be securely stowed. Equipment 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. syringe pump) be left on top of the patient trolley.

This may become a dangerous projectile in the event of a sudden deceleration. Gas cylinders must be held in secure housings at all times.

High speed journeys should be avoided except where strictly necessary. Blue lights and sirens may be used to aid passage through traffic to deliver a smooth journey.

Air Transport ▼

Whether using helicopters or fixed wing aircraft, 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. The information below is taken from Guidance On: the Transport of The Critically Ill Adult (2019) and highlights the issues which may be relevant for those preparing a patient for air transfer.

A fall in barometric pressure results in a reduction in alveolar partial pressure of oxygen and may lead to hypoxaemia. Increased inspired oxygen concentration is mandatory for all aeromedical transfers.

A fall in barometric pressure also leads to an increase in the volume of gas filled cavities within the patient. Endotracheal tube cuff pressure should be monitored or the cuff filled with saline. 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".

Increased altitude is also associated with a fall in temperature and additional measures may be required to keep the patient warm. Noise and vibration may cause nausea, pain and motor dysfunction. Anti-emetic pre-medication should be available for patients and ear protection provided.

Staff without appropriate training should not undertake aero-medical 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 transfer is however desirable.

References & Further Reading ▼

Guidance On: the Transfer of The Critically Ill Adult (2019) Faculty of Intensive Care Medicine and Intensive Care Society. Available at www.ics.ac.uk

Appendix 1- WYCCODN Transfer Risk Assessment

Transfer Risk Assessment

Risk assessment is to some extent subjective and other facto[redacted] not listed may influence the perceived risk. The risk tool is provided for guidance only. It is the referring Consultant's responsibility to ensure that the transfer is appropriate and that the transferring team have the necessary skills required.

Low Risk

NEWS 1-4

Maintaining airway

FiO2 < 0.4 / Base deficit 0 to – 4mmol/l

Not requiring inotrope / vasopressor support

GCS ≥ 14

Normothermic

Nurse / Practitioner with appropriate competencies only.

Medium Risk

NEWS 5-6

Maintaining airway

FiO2 < 0.4 – 0.6 / Base deficit – 4 to – 8 mmol/l

Low dose inotrope / vasopressor support < 0.2ug/kg/min

GCS 9-13 (consider elective intubation)

Hypo / Hyperthermic

Doctor accompanied by Nurse / Practitioner with appropriate competencies. If potential to deteriorate then doctor should have critical care and advanced airway competencies.

High Risk

NEWS 7 or more

Intubated / ventilated

FiO2 > 0.6 / Base deficit worse than – 8 mmol/l

CVS unstable and / or requiring inotrope / vasopressor support > 0.2ug/kg/min
Hypo / Hyperthermic

Major trauma e.g head / chest / abdominal / pelvic injuries

Doctor with critical care and advanced airway competencies accompanied by Nurse / Practitioner with appropriate competencies.

NEWS Score ☐ **Level of risk: Low ☐ Medium ☐ High ☐**

Name..

Designation ....

Signature ....

Date ☐ **Time** ☐

Appendix 2 - Competencies ▾

Nursing

STEPS 1 - 1.11 Intra & Inter Hospital Transfer

The following competency statement is about the effective coordination and management of intra & Inter hospital transfers for critically ill patients, it includes those individuals who require emergency transport to a different location for investigation, treatment, intervention or on-going care

1:1.11	Assisting in the preparation and transfer of the critically ill	Competence Fully Achieved Date/Sign
	You must be able to demonstrate through discussion essential knowledge of (and its application to your supervised practice):	
	• Your role in the intra & inter hospital transfer of a critically ill patient • Indications for transfer from critical care • Expected sequence of events • Importance and implications of time critical transfers Transfer process including the different considerations for transfer decisions: • Responsibility of care during transfer • Identification of correct patient • Consent • Competency and skills of transferring personnel • Physiological assessment and optimisation pre transfer • Patient history, treatments and diagnostic tests • Competency and skills of transferring personnel • Risk assessment of patient physiological requirements and maintenance of homeostasis during transit • Infection status • Calibration of appropriate equipment • Emergency equipment and transfer bag • Contingency planning/back up considerations • Drug administration during transfer • Documentation and audit Methods, procedures and techniques for the portable monitoring and the types of equipment required during transfer (outline the calibration requirements and battery life expectancy/expiry date of each): • Mechanical Ventilator • Oxygen supply (including flow rates and journey time) • Vital signs monitor	

- Invasive lines
- Infusion devices/syringe pumps
- Suction equipment
- Transfer bag
- Spinal board

Implications of standardised monitoring techniques and explain the necessity/appropriateness of each during transfer:

- Continuous ECG
- Arterial blood pressure versus non -invasive blood pressure
- SpO_2
- Continuous capnography with wave form analysis
- CVP
- Temperature

Emergency situations that may arise on transfer

- Airway management
- Alternative ventilation methods
- Alternative monitoring techniques (non-invasive methods)
- Basic and advanced life support
- Interpretation of vital signs
- Alteration of treatment plans to maintain homeostasis
- Titration of medications to optimise condition

Process for preparing to transfer the critically ill patient:

- Contents of the local emergency/transfer bag and identify the situations in which it may be required
- Pharmacology requirements of the patient being transferred
- Pre preparation considerations required for drug administration during transfer
- Process and sequence of communication required prior to, during and following transfer
- Safe moving and handling of the individual and equipment being transferred
- Needs of family for information about transfer

Documentation that needs to be completed for intra & inter hospital transfer:

- Transfer form
- Physiological observation chart
- Nursing evaluation
- Reporting of clinical incidents
- Audit tool

	You must be able to undertake the following in a safe and professional manner:	
	Assist in the physiological optimisation/stabilisation of the patient prior to transfer Assist in the preparation of equipment and resources: • Airway management • Portable ventilation • Suction equipment • CV support • Vital sign monitoring • Fluid therapy & pharmacological requirements • Infusion devices/syringe drivers • Transfer bag • Psychological support Assist in the location, calibration and safely set up monitoring and transfer equipment including: • Alarm parameters • Prepare electromechanical devices • Supplementary gases • Transportation • Establishing optimum level of stability on portable equipment prior to transfer Assist in and maintain the safety and continued treatment of the critically ill patient during transfer	

STEPS 2 - 2.7 Intra & Inter Hospital Transfer

The following competency statements relate to the preparation required prior to and the management of patients during intra & inter hospital transfer. It is intended that the competencies in this section will build on the knowledge and skills you gained in Step 1.

2:7.1	Preparation and transfer of the critically ill	Competence Fully Achieved Date/Sign
	You must be able to demonstrate your knowledge using a rationale through discussion, and the application to your practice	
	Policies/procedure/guidelines related to the transport of the critically ill patient: • ICS guidelines • Regional standards • Risk assessment • Local policy • Bed management systems • Transfer audit documentation Role of team members when arranging and carrying out an intra & inter hospital transfer Complete a comprehensive risk assessment in collaboration with the MDT to ensure the patient is fit or suitable for transfer Identify the potential risks associated with transferring critically ill patients Indications for transfer from critical care including the: • Nature: repatriation, specialist treatment, investigation, continuing care • Sequence of expected event • Urgency and time critical transfers • Reasons for reviewing individuals' priorities, needs and the time frame with which this should be undertaken Transfer process including the different considerations for clinical and non-clinical transfer decisions: • Communication with relatives and on-going updating of the situation as required • Ethical issues • Legal requirements • Local escalation policies	

- Bed management system
- Referral to receiving hospital (including critical care and specialty consultants)
- Responsibility of care during transfer
- Indemnity insurance
- Competency and skills of transferring personnel
- Risk assessment of patient's physiological requirements and maintenance of homeostasis during transit
- Contingency planning/back up considerations
- Drug administration during transfer
- Type of transport required, time critical issues, bariatric patients
- Communication with receiving hospital prior to transfer
- Documentation and audit

Differing types of transport available and make recommendations for which is the most appropriate

Process for organising the appropriate transport:

- Ambulance service
- Vehicle specification (including on board resources and equipment)
- Ambulance equipment
- Types of transfer trolley available
- Storage of transport equipment in transit
- Time critical transfer issues

Process for preparing to undertake an intra / inter hospital transfer of a critically ill patient:

- Gathering of extra battery packs, alternative equipment in case of malfunction
- Clinical notes/radiology reports/recent blood profiles/investigations
- Assessment of patient's physiological requirements during transfer
- Accuracy of portable monitoring and equipment
- Re assess safety/risk factors prior to transfer

Process and sequence of communication required for providing oral reports/discussions:

- Information and informed consent in the conscious patient
- Discussion with family members
- Verbal referral and handover of patients condition to receiving unit/service

- Handover of condition and physiological requirements to the transfer team/personnel
- Sharing information with the team in relation to safety, risk assessments and contingency planning
- Contact receiving unit/service on departure
- Formal handover to receiving unit/service on arrival

Documentation that needs to be completed in an accurate, concise and systematic manner during a inter hospital transfer, with appropriate duplications:

- Transfer form
- Physiological observation chart
- Nursing evaluation
- Reporting of clinical incidents
- Audit tool

Prepare the patient for transfer by assisting the wider MDT in the physiological optimisation/stabilisation

- Assess potentially competing needs of the patient for pre-transfer optimisation and specialist care
- Assess clinical condition of patient before leaving the critical care unit

Maintain the safety of the patient during transfer:

- Assessment of the extra physiological stresses experienced by the patient during inter-hospital transfer
- Anticipation of potential problems and planning to reduce the likelihood of their occurrence
- Maintenance of situational awareness and readiness to respond to threatening situations if and as they occur

Demonstrate awareness of situational factors that could impact on the quality and safety of a critical care transfer

Identify areas in your own transfer practice that could be improved

Reflect on your own transfer experience

Royal College of Anaesthetists Curriculum 2010 - Transfer Medicine ▼

Transfer Medicine

The learning outcomes and competencies listed are those necessary for the first 24 months of anaesthetic training. It is strongly recommended that CT 1/2 trainees complete this unit of training before undertaking intra-hospital transfer with distant supervision. Many of the competencies may be attained whilst gaining training and experience in intensive care.

Learning outcomes:

- Correctly assesses the clinical status of patients and decides whether they are in a suitably stable condition to allow **intra-hospital transfer [only]**
- Gains understanding of the associated risks and ensures they can put all possible measures in place to minimise these risks

Core clinical learning outcome:

- Safely manages the intra-hospital transfer of the critically ill but stable adult patient for the purposes of investigations or further treatment [breathing spontaneously or with artificial ventilation] with distant supervision

NB: All competencies annotated with the letter 'E' can be examined in any of the components of the Primary examination identified in the FRCA examination blueprint on page B-99 or in the Final examination identified in the Final FRCA blueprint on page C72 of Annex C.

Knowledge

Competence	*Description*	*Assessment Methods*	*GMP*
TF_BK_01	Explains the importance of ensuring the patient's clinical condition is optimised and stable prior to transfer	A,C,E	1,2
TF_BK_02	Explains the risks/benefits of intra-hospital transfer	A,C,E	1,2
TF_BK_03	Recalls/describes the minimal monitoring requirements for transfer	A,C,E	1,2,3
TF_BK_04	Lists the equipment [and back up equipment] that is required for intra-hospital transfer	A,C,E	1,2
TF_BK_05	Outlines the physical hazards associated with intra-hospital transfer	A,C,E	1,2
TF_BK_06	Explains the problems caused by complications arising during transfer and the measures necessary to minimise and pre-empt difficulties	A,C,E	1
TF_BK_07	Outlines the basic principles of how the ventilators used for transfer function	A,C,E	1
TF_BK_08	Indicates the lines of responsibility that should be followed during transfer	A,C,E	1,2,3

Knowledge			
Competence	*Description*	*Assessment Methods*	*GMP*
TF_BK_09	Outlines the consent requirements and the need to brief patients in transfer situations	A,C,E	1,2,3,4
TF_BK_10	Outline the issues surrounding the carrying/recording of controlled drugs during transfer	A,C,E	1,2,3
TF_BK_11	Describes the importance of keeping records during transfer	A,C,E	1
TF_BK_12	Outlines the problem of infection and contamination risks when moving an infected patient	A,C,E	1,2
TF_BK_13	Explains how to assess and manage an uncooperative and aggressive patient during transfer	A,C,E	1,2,3,4
TF_BK_14	Understands hospital protocols governing transfer of patients between departments	A,C,E	1
TF_BK_15	Outlines the importance of maintaining communication, when appropriate with the patient and members of the transfer team.	A,C,E	1,2

Skills			
Competence	*Description*	*Assessment Methods*	*GMP*
TF_BS_01	Demonstrates the necessary organisational and communication skills to plan, manage and lead the intra- hospital transfer of a stable patient	A,M	1,2,3,4
TF_BS_02	Demonstrates how to set up the ventilator and confirm correct functioning prior to commencing transfer	A,D	1,2
TF_BS_03	Demonstrates safety in securing the tracheal tube securely prior to commencing the movement/transfer	A,D	1,2
TF_BS_04	Demonstrates the ability to calculate oxygen and power requirements for the journey	A,D	1,2
TF_BS_05	Demonstrates safety in securing patient, monitoring and therapeutics before transfer	A,D	1,2,3,4
TF_BK_06	Demonstrates how to check the functioning of drug delivery systems	A,D	2,3
TF_BS_07	Demonstrates appropriate choices of sedation, muscle relaxation and analgesia to maintain the patient's clinical status during transfer	A,C,D,M	1,2
TF_BS_08	Demonstrates the ability to maintain monitoring of vital signs throughout transfer	A,D	1,2
TF_BS_09	Demonstrates the ability to maintain clinical case recording during transfer	C,M	1

Transfer medicine

Learning outcome:

- Build on the knowledge, understanding and skills obtained in Basic Level training, so developing greater confidence and ability to provide clinical care to patients requiring transfer, including those for **inter**-hospital transfer

Core clinical learning outcomes:

- To deliver safe and efficient transfer [with distant supervision] of:
  - Complex patients for intra-hospital including retrieving a newly referred ITU patient from A&E or the wards
  - An uncomplicated ventilated patient for inter-hospital transfer by land [Less than 4 hours]

NB: All competencies annotated with the letter 'E' can be examined in any of the components of the Final examination identified in the FRCA examination blueprint on page C-73.

Knowledge			
Competence	*Description*	*Assessment methods*	*GMP*
TF_IK_01	Explains the risks/benefits of Interhospital patient transfer	C,E	1,2,3,4
TF_IK_02	Explains the concept of primary/secondary/tertiary transfer	C	
TF_IK_03	Outlines the hazards associated with Interhospital transfer, including but not limited to physical, psychological and organisational	C,E	1,2,3,4
TF_IK_04	Describes the increased risks to critically ill patients of transfer and the reasons for these risks	C,E	1,2
TF_IK_05	Outlines strategies to minimise risk during Interhospital transfer, including but not limited to: o Stabilisation o Pre-emptive intervention o Sedation o Monitoring o Packaging o Choice of mode of transfer	C,E	1,2,3,4

Knowledge			
Competence	*Description*	*Assessment methods*	*GMP*
TF_IK_06	Explains how critical illness affects the risk of transfer	C,E	1
TF_IK_07	Explains how time-critical elements may influence risks to the patient and transfer personnel and how these should be managed to reduce them	C,E	1,2,3
TF_IK_08	Understands the increased risk of interventions during Interhospital transfer	C,E	1,2,3
TF_IK_09	Outlines the specific considerations for transfer of patients with specific clinical conditions, including but not limited to: o head, spinal, thoracic and pelvic injuries o critically ill medical patients o burns o children o pregnant women	C,E	1,2
TF_IK_10	Lists and explains the critical care equipment used during transfer including but not exclusively: • Ventilators • Infusion pumps • Monitoring	C,E	1,2
TF_IK_11	Lists the different modes of ventilation and explains the selection of appropriate parameters in e.g. Asthma/COPD and ARDS	C,E	1
TF_IK_12	Outlines the different modes of transport available for inter-hospital transfer, including risks/benefits	C,E	1,2
TF_IK_13	Understand the safety implications of electrical and hydraulic equipment that may be used during patient transfer	C,E	1,2
TF_IK_14	Recalls/describes the physiological effects of transport including the effects of acceleration and deceleration, including Newton's laws of motion	C,E	1
TF_IK_15	Understands the effects of high ambient noise on patients and alarm status	C,E	1,2
TF_IK_16	Recalls/discusses the reasons for patients becoming unstable during transfer and strategies for management	C,E	1
TF_IK_17	Recalls/describes how to manage patients who develop sudden airway difficulties whilst in transit [both in the intubated and un-intubated patient]	C,E	1,2
TF_IK_18	Outlines the ethical issues related to patient transfer, including the need to brief patients and their relatives	C,E	3,4
TF_IK_19	Awareness of the laws relating to deaths in transit	C,E	1
TF_IK_20	Outlines how to find and use the national register of critical care beds	C,E	1

Knowledge			
Competence	*Description*	*Assessment methods*	*GMP*
TF_IK_21	Outlines the regional protocols for organising transfers between units	C,E	1
TF_IK_22	Outlines the importance of maintaining communications between the transfer team and the base/receiving units	C,E	1,2,3
TF_IK_23	Outlines the roles and responsibilities of all staff accompanying the patient during transfer including the ambulance technicians and paramedics	C,E	1,2
TF_IK_24	Describes the personal equipment needed when leading a transfer, especially when a prolonged journey is anticipated	C,E	1,2
TF_IK_25	Discusses the importance of auditing practice and reporting critical incidents that arise during Interhospital transfer and the need for appropriate research	C,E	1,2,3,4

Skills			
Competence	*Description*	*Assessment methods*	*GMP*
TF_IS_01	Demonstrates ability to determine when patients are in their optimum clinical condition for transfer	A,D	1,2,3,4
TF_IS_02	Demonstrates the ability to optimally package a patient for Interhospital transfer to minimise risks	A,D	1,2,3,4
TF_IS_03	Demonstrates the ability to establish appropriate ventilation and monitoring required of a critically ill patient for interhospital transfer	A,D	1,2,3
TF_IS_04	Demonstrates the ability to safely sedate a patient for interhospital transfer	A,D	1,2
TF_IS_05	Demonstrates ability to know when the patient's needs exceed the local resources available/that specific expertise is required	A,C	1,2,3,4
TF_IS_06	Demonstrates the need to integrate patient diagnosis with the physiological effects of transport	A,C,S	1,2
TF_IS_07	Demonstrates the ability to manage sudden loss of airway control, vascular access and monitoring in patients during transfer [S]	D,S	1
TF_IS_08	Demonstrates the necessary organisational and communication skills in managing inter-hospital transfers safely and effectively, recognising the importance of maintaining contact with base/receiving units if necessary whilst on transfer	D,M	3,4
TF_IS_09	Demonstrates appropriate situational awareness	D,A,S	2,3

Appendix 3 - Transfer Bag & Contents ▾

It is recommended that the equipment available in transfer bags be standardised across the WYCCODN to support trainees moving between trusts. The suggested contents list is shown below

Advanced Airway Equipment		**Breathing Equipment**		**Circulation Equipment**	
1. ET Tube size 6	1	1. I-gel size 3	1	1. IV cannula size 14G	2
2. ET Tube size 7	1	2. I-gel size 4	1	2. IV cannula size 16G	2
3. ET Tube size 8	1	3. I-gel size 5	1	3. IV cannula size 18G	2
4. ET Tube size 9	1	4. Airway HME Filter	1	4. IV cannula size 20G	2
5. Laryngoscope Handles , Bulbs & Batteries	2	5. Catheter Mount	1	5. IV cannula size 22G	2
6. Laryngoscope Blade size 3	1	6. Sterile scissors	1	6. Pairs of non sterile gloves	10
7. Laryngoscope Blade size 4	1	7. Anaesthetic mask size 4 Green	1	7. Luer lock syringes 20ml	5
8. Endotracheal ties	2	8. Anaesthetic mask size 5 Orange	1	8. Luer lock syringes 50ml	4
9. Magill Forceps	1	9. Stethoscope	1	9. Chloraprep skin wipes	3
10. Tape for securing ET	1	10. Wave form capnograph	1	10. Alcohol wipes	10
11. Lubricant gel sachets	3	11. Waters circuit	1	11. Blood./Colloid fluid giving sets (Gravity)	2
12. Stylet	1			12. Infusion device giving sets	5
13. Gum Elastic Bougie	1	**Suction Equipment**		13. Infusion device extension sets	5
14. Tracheal dilator	1	1. Yankauer suckers	2	14. 3-way taps (or equivalent)	4
15. Scalpel size 22	1	2. Suction catheters (10F)	2	15. Obturators (Red and/or white bungs)	10
16. 10ml syringe	1	3. Suction catheters (12F)	2	16. Micropore tape	1
17. Torch	1	4. Suction catheters (14F)	2	17. Gauze swabs	4
18. Face masks	2	5. Suction tubing	2	18. Cannula dressings	5
19. ETC02 indicator	1			19. ECG Electrodes	12
				20. Trauma shear scissors	1
		External Equipment		21. Labels	10
		1. Self-inflating bag and mask with oxygen reservoir and tubing (BVM)	1	22. Sodium Chloride ampoules (flush)	10
Self-ventilating Equipment		**Interventional circulation Equipment**		**Inside pounch on side of bag**	
1. Gudel airway size 2	1	1. Intraosseous Device	1	1. Clinical waste bags	2
2. Gudel airway size 3	1	2. Intraosseous Needles	3	2. Sharps box (to be sourced locally)	1
3. Gudel airway size 4	1	3. Needles Green	5	3. IV Fluids (crystalloid) 500ml	3
4. Nasopharyngeal airway 6	1	4. Needles Blue	5	4. Pressure bag	1
5. Nasopharyngeal airway 7	1	5. Needles White	5	5. Handheld Portable Suction	1
6. Non rebreathe oxygen mask size 4	1	6. Drawing up needles	5		
7. Non rebreathe oxygen mask size 5	1	7. Tourniquets	2		
8. Oxygen tubing	2				

Transfer bags should be routinely checked and restocked after each use.

Inter-hospital Transfer Form

West Yorkshire
Critical Care & Major Trauma
Operational Delivery Networks

Risk Assessment Please complete BOTH the Risk Assessment and Pre Transfer Checklist (the back sheet of this form) prior to transfer:

Transfer Risk: Low ☐ Medium ☐ High ☐

Pre Transfer Checklist Completed: ☐

Patient Details (or patient sticker on each sheet)

Surname .... Date of Birth ....
First name .... NHS number ....
Address ....

Transfer Details

Transferring Hospital ....
Unit / Department / Ward ....
Referring Consultant ....
Receiving Hospital ....
Unit / Department / Ward ....
Specialty Consultant accepting transfer ....
ICU Consultant accepting transfer ....
Contact number ....

Reason for Transfer

Specialty care ☐ State specialty ....
CC bed space available but not staffed ☐
No CC bed space available ☐ Repatriation ☐

YAS Response Requested

Cat 2 - Emergency Transfer ☐
Cat 3 - Urgent Transfer for escalation of care ☐
(Critical Care transfers should be managed under Cat 3, unless there is an urgent need to move the patient to free up a bed for another patient)
Cat 4 - Non Urgent/Planned Transfer ☐
Booking Reference Number ....
See YAS IFT Guidelines for more details

Transfer Timeline	Date	Time
Referral Accepted (bed available)	/ /	:
Ambulance Requested	/ /	:
Ambulance Arrived	/ /	:
Departure from Base	/ /	:
Arrival at Destination	/ /	:
Team Departure	/ /	:

Transferring Personnel

Doctor (Name) .... Grade ....
Nurse (Name) .... Grade ....
Other (Name) .... Grade ....

Primary Diagnosis

Level of Care Required L2 ☐ L3 ☐

Airway

Maintaining Own Airway ☐
Endotracheal Tube ☐
Tracheostomy ☐

Ventilation

Oxygen (via NC/mask) ☐
NIV/CPAP (via face mask/hood) ☐
Invasive Ventilation (via ETT/Tracheostomy) ☐
FiO2 (max) ....
Peak Airway Pressure ....
PEEP ....
VT ....
Number of chest drains ....

Monitoring

ECG ☐
NIBP ☐
Arterial BP ☐
CVP ☐
ETCO2 ☐
Oxygen saturation ☐
Intracranial pressure ☐

Vascular Access Devices

Intraosseous ☐
Peripheral ☐
Central (CVP) ☐
Vascath ☐

Infection Status (Please specify any infection)

Critical Incident During Transfer Yes ☐ **No** ☐
(please specify)

Details recorded in patient notes : YES ☐ **Datix Ref** ....

Notes or Additional Comments

Handover Completed

Escorting Doctor / Nurse	Date	Time
Name	/ /	:
Signature		

Receiving Doctor	Date	Time
Name	/ /	:
Signature		

Frequency of observations to be determined by clinical need. Suggested minimum frequency every 15 minutes.

GCS	TIME		
	EYES (1-4)		
	VERBAL (1-5)		
	MOTOR (1-6)		
	GCS TOTAL (3-15)		

GCS	1	2	3	4	5	6
Eyes	None	To pain	To Speech	Spontaneously		
Verbal	None	Incomprehensible	Inappropriate	Confused	Orientated	
Motor	None	Extension	Abnormal Flexion	Normal Flexion	Localise Pain	Obeys Commands

PUPILS	RIGHT	SIZE	
		REACTION	
	LEFT	SIZE	
		REACTION	
SEDATION	RASS SCORE		
DRUGS			
FLUIDS			
VENTILATION PARAMETERS	FiO_2		
	$ETCO_2$		
	PEAK AIRWAY PRESSURE		
	TIDAL VOLUME (mls)		
	SpO_2		
	RESPIRATORY RATE		

Pupil size scale: 1, 2, 3, 4, 5, 6, 7, 8

BP AND PULSE RATE: 190, 180, 170, 160, 150, 140, 130, 120, 110, 100, 90, 80, 70, 60, 50, 40, 30, 20

BLOOD GLUCOSE
CENTRAL VENOUS PRESSURE
URINE OUTPUT
CHEST DRAINAGE
TEMPERATURE

Top (White) **copy to be placed in patient record in receiving unit, Middle** (Pink) **copy to be returned to WYCCODN office* for audit purposes, Bottom** (Yellow) **copy to be retained by transferring unit and placed in patient records.**
***Manager / Lead Nurse WYCCODN, 2nd Floor, 2 Park Lane, Leeds LS3 1ES**

West Yorkshire
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Operational Delivery Networks

Information Sheet for Patient Transfer from ICU to ICU

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Patient ID Label	
Name	
DOB	
NHS Number	
Hospital Number	

Preferred Name	
Age	
Gender	
Religion	
Preferred Language	

Hospital Admission date	
ICU/HDU Admission date	
DOB	
Consultant	

Contact Details	**First Contact**	**Second Contact**	
Name			
Relationship to patient			
Address			
Contact Number			
Past Medical History			
Allergies			
Diagnosis			
Infection Status			
Antibiotics			
Summary of Critical Care Admission			
Social Issues			
DNACPR form completed	YES/NO	If yes, date of last review	

Airway	
ETT/Tracheostomy	*Please circle*
Size	
Type of tube	
Length at lips	
Date of Intubation	
Grade of Intubation	
Date of last tube change	

Disability		
Pre sedation GCS		
Sedated		
RASS Score		
CAM-ICU		
Pupil Size/Reaction	L	R
Pain Score		
Blood Sugar		
Sliding Scale		
Wounds		

Breathing	
Ventilation mode	
Respiratory/Ventilator Rate	
FiO_2	
PEEP	
Pressure Support	
Tidal Volume	
Target SaO_2	
Secretions	
Nebulisers	Yes/No

Exposure	
Temperature	
Enteral/Parental Nutrition (Type of feed)	
Rate of feed	
Bowels last opened	
Type of stool	
Skin Assessment	

Circulation	
Heart Rate/Rhythm	
Blood Pressure	
Target MAP	
Inotropes	
Urine output over last 4 hours	
Renal Replacement Therapy	Yes/No
Secretions	
Nebulisers	

Additional Information

Indwelling Devices			
Device	**Date of Insertion**	**Site**	**Comments**
Arterial Line			
CVC			
Vascular Catheter			
Peripheral Cannula 1			
Peripheral Cannula 2			
NG/NJ			
Urinary Catheter			
Faecal Management			
Drain 1			
Drain 2			
Other			

Nurse Completing (print name)		**Nurse Handing Over** (print name)		**Nurse Accepting patient** (print name)	
Signature	**Date**	**Signature**	**Date**	**Signature**	**Date**

West Yorkshire
Critical Care & Major Trauma
Operational Delivery Networks

The West Yorkshire Adult Critical Care and Major Trauma Operational Delivery Networks are regionally based. It is a collaborative partnership enabling clinical services to work together to promote the highest quality services for the region.

www.wyccn.org
www.wymtn.com

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