All Wales Critical Care (& Trauma) Networks Regional Transfer Course

Transferring the Critically Ill Adult

PRE-COURSE HANDBOOK

5th Edition May 2016

Contents

Acknowledgements

Many people have put a lot of hard work, not only into the production of this handbook and Transfer Course but also into developing a Transfer Infrastructure to improve the quality and safety of critical care transfers in Wales. The North Wales Critical Care & Trauma Network would therefore like to thank all the contributors for their hard work and support.

Background Information

When Critical Care Networks were first established in 2007 the All Wales Critical Care Advisory Group, on behalf of the Welsh Government, tasked the North Wales Network with developing and implementing an all Wales transfer and transport framework. This was to include the production of an all Wales policy and procedure in line with Welsh Quality Requirements for Transport of Critically Ill Patients. The framework was to also include the identification of standardised education, communication, equipment and audit.

The auditing process facilitates knowledge about transfer quality as well as activity. The data and information is used for improvement by informing transfer course delegates about patient safety issues as well as being fedback directly to clinicians involved, whether the transfers was assessed favourably or not.

Step One - Transfer form compliance
Transfer forms received in the Network are cross-referenced with information obtained from the daily ring around in which each Critical Care Unit and Emergency Department in Wales is contacted. A compliance rate of forms returned is thus ascertained. The rationale for this is to feedback to regional Network Transfer Groups where improvements may need to be made. The reports provided to each Network contain this information broken down to individual units.

Step Two - Data compliance
Information from each form is entered into the database. A data compliance score is generated from information completed; this is weighted according to importance of data field.

Step Three - Assessment grading
Each month database reports and the original transfer forms are assessed by at least two Intensivists for the quality of transfer. To reduce subjectivity a scoring matrix is used. The Intensivists initially score the forms individually and then discuss and agree a final assessment grade. Transfer quality may be graded as excellent, good, borderline, poor or uninterpretable

Step Four – Network Reports
Once the database has been updated to include the assessment grades and assessors' comments a summary and full report are submitted to the relevant Network. The transfer forms are scanned for electronic storage and then the originals sent back to the Networks with their reports. These reports are discussed at the Network Regional Transfer Groups.

Significant improvements in the quality and safety of transfers have been seen since the establishment of the transfer framework and implementation of the guidelines, audit process and All Wales Transfer training.

Transfer of the Critically Ill Adult Course

Introduction

This Transfer course is designed to be delivered on a regional basis bringing together local and regional experts to impart their knowledge. These experts will include members of;

- The Ambulance Service.
- Neuro critical care specialists.
- Local experts.

The course is in three parts to be carried out on three different days. The reason for this is that each hospital uses *different equipment*. A fundamental part of transfer training is learning to use equipment effectively. From a practical point of view, the equipment part of the course can only effectively be delivered in base hospitals in small tutorial groups. Conversely, lectures can be delivered to larger audiences and makes the bringing in of expert groups easier. Part A and part B must be completed successfully by all delegates to be regarded as transfer competent. Part C is an add-on for those likely to partake in air transfers.

The course is based on the Welsh Guidelines for the Transfer of the Critically Ill Adult[1], originally published in 2009. A full version of this document can be found at (please note these are currently being revised);
http://www.wales.nhs.uk/sites3/Documents/753/Guidelines%20for%20the%20transfer%20of%20the%20critically%20ill%20adult.pdf

Part A

Lecture and workshop based one-day course
Workshops include – Ambulance and MCA S-92 Search and Rescue Helicopter and/or Air Ambulance orientation, Communication and Good, Bad and Ugly transfer forms and Multiple choice questions.

Part B

Practical half-day course (for skills see pg 40)
This will consist of;

1. Patient packaging using the Ferno trolley and splint
2. Equipment - Learning and familiarising yourselves with;
    a) Transfer ventilator
    b) Pumps
    c) Monitors
3. Oxygen calculations, cylinder training, drug rationalisation

Part C

Practical session spent with the Search and Rescue team. This is only available for those most likely to transfer by air as places are limited. You will spend the session learning what medical equipment is on board and how to use it. You will also be taught the safety aspects of flying, learning the ropes and hopefully experience flying in MCA S-92 Search and Rescue Helicopter.

Course aims

The aim is *not* to teach you how to be doctors, nurses or ODPs. That core knowledge has been tested by other bodies. The aim of this course is to teach a system and a process and help you avoid the common pitfalls which occur during transfers. A common cause of transfer mishap is lack of knowledge of equipment which is why part B is also very important.

Who should attend this course?

This course is open to anyone who is likely to undertake a critical care transfer, be it intra or inter-hospital.
The course concentrates mainly on Level 2 (High Dependency) and Level 3 (Intensive Care) transfers.
Attendees will generally be;

a) Doctors - Anaesthetists and Emergency Department of any grade
b) Nurses - Critical care, Emergency Department and theatre nurses
c) Operating Department Practitioners (ODPs)

Why come on this course?
Transfer training is the last frontier of training. Nowadays in medicine and nursing there is quite rightly a lot of regulation regarding competencies. However we can still climb in the back of a helicopter or ambulance with a critically ill patient without any training at all. Difficulties arise as this is not an environment that we are use to and it can feel alien and hostile.

It is easy to forget that all critical care patients must receive the same level of care during their transfer as they would get in the Unit.

We hope that this course addresses this problem and highlights the pitfalls in transfer. It will hopefully change the way you think about transfers and prevent you making the same errors which crop up time and time again.

Chapter One

Communication

Introduction

Suboptimal communication between healthcare professionals is widely recognised as a significant causative factor in incidents compromising patient safety[2]. 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. A cross-sectional case review of incidents relating to the transfer of critically ill adults in an Australian study identified that of 191 reported incidents, 61% were patient / staff management issues of which a significant number were directly attributed to communication failures[3]. Furthermore, this ineffective communication led to increased transfer times for a number of patients, a significant factor which contributed to the increased risk of physiological complications[4].

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, although overall responsibility for the patient, including the communication and documentation, always lies with the clinician in attendance[1]. It is acceptable however to delegate roles to named individuals within the team as the communication process can be extremely time consuming.

When considering what needs to be communicated during the transfer process, it is useful to first identify key actions for communicating with the following:

1. Communication with the receiving hospital.
2. Communication with Ambulance Control.
3. Communication with the patient's family / next of kin.

Communication with the receiving hospital

The decision to transfer a patient to another hospital must be made by a consultant responsible for the patient at the referring hospital. Likewise, the decision to accept a transferred patient must be made by a consultant responsible for the Critical Care Unit at the receiving hospital[1]. For major trauma patients however the decision to accept may be made by the Trauma Team Leader (TTL).

Initial communication will therefore begin with a telephone call between these two individuals and clear answers are required of the following questions[5]:

- Why is the transfer occurring now?
- Is the medical risk acceptable?

The decision to transfer should then be documented clearly within the patient's medical notes and should include the name of the doctor making the decision, designation, GMC number and contact details. The date, time and reason for decision to transfer must also be documented including whether it is for clinical or non-clinical reasons[6].

As with any telephone conversation from here on, it is crucial that all relevant information is communicated and understood by personnel involved. Clinicians receiving referrals over the telephone may interrupt, have varying degrees of co-operation and may question, prompt or even lead the conversation.

It is therefore useful to follow a structured approach with each communication event[7]:

- Who you are.
- What is needed (from the listener).

- What the (relevant) patient details are.
- What the problem is.
- What has been done to address the problem.
- What happened.
- What is needed (repeated from the listener).

Examples of communication with the receiving hospital include:

- Critical Care Consultant– Consultant TTL or Neurosurgeon (or another tertiary specialty)
- Critical Care Consultant– Critical Care Consultant
- Senior Critical Care Nurse– Senior Critical Care Nurse
- Senior Critical Care Nurse– Receiving Hospital Bed Manager
- Bedside Nurse Referring Hospital– Bedside Nurse Receiving Hospital

All of the above mentioned individuals should provide and receive NAMED personnel to ensure future communication remains clear, concise and consistent. Any changes to the patient's condition must be communicated to the receiving hospital and estimated time of arrival confirmed.

Prior to leaving the referring unit, it is useful to refer to a final checklist ensuring all aspects of communication have been addressed.

Checklist for Communication prior to Departure

- Location of bed and receiving doctor's name.
- Telephone numbers of referring and receiving units.
- Receiving unit advised of departure time.
- Relatives informed.
- Police escort arranged (if indicated).
- Ambulance crew briefed by transferring doctor.
- Case notes, x-rays, scans, results and blood (if required).
- Critical Care Network Transfer documentation prepared.

Finally, on arrival at the receiving hospital, there should be a formal handover between the transferring team and both the medical and nursing staff at the receiving unit. This handover should include a verbal and written account of the patient's history, vital signs, treatment and significant events during transfer. X-rays, scans, other investigations and blood products (if applicable) should be handed over at this point[1].

Communication with Ambulance Control

As discussed earlier, the decision for transfer and responsibility for the patient always lies with the clinician in attendance, who may or may not decide to transfer the patient personally[1]. It is acceptable however to delegate the transfer arrangements to a suitably experienced practitioner within the referring hospital. It is recommended that this NAMED individual contacts the ambulance control room via switchboard as early in the transfer process as possible and communicates with the *ambulance control duty manager*. Again, future communication remains clear, concise and consistent where this process is followed. The degree of urgency should be specified clearly at this point:

- Immediate – within 30 minutes from the time of call.
- Urgent – within 2 hours; at a time specified by the referring hospital.
- Elective – endeavour to arrive at a time specified by the referring hospital.

Ambulance control will require answers to the following questions so it is useful to have this information prior to making the call:

- Name of hospital and department you are calling from.
- Patient details.
- Name and location of receiving hospital.
- Department/Unit of receiving hospital.
- Escorting personnel.

- Specific Requirements e.g. Oxygen requirements, IV Infusions.

For more detail on requesting an ambulance refer to Cue Cards page 33/34 Welsh Guidelines for the Transfer of the Critically Ill Adult.

Communication with the patient's family / next of kin

As with all other forms of communication regarding the transfer of a critically ill patient, the aim is to ensure that the message is clearly received and understood. Again, a NAMED practitioner should establish and maintain effective channels of communication with the patient's family to avoid confusion and unnecessary stress in what must be an extremely worrying time. It is reasonable that this individual could be either the Bedside Nurse or Senior Critical Care/ED Nurse as a familiar, trusting relationship may have already been established although any clinician with the appropriate skills may take on this role as long as the message remains honest and consistent.

The patient's family should receive a full and honest explanation as to the decision to transfer with an opportunity to ask questions and voice concerns.

It may be of comfort to the patient's family to receive a named individual at the receiving hospital.

A map with instructions and directions of how to get to the receiving hospital should be issued at the referring unit. It is vital that the family are instructed NOT to attempt to follow the ambulance for health and safety reasons.

As with all communication, discussions held with the family should be clearly documented within the patient's medical notes.

In conclusion, clear and effective communication is an essential part of the transfer process and all messages, either verbal or written, must be clear, concise and consistent.

Chapter Two

Resuscitation and the Primary Survey

Introduction

Meticulous resuscitation and stabilisation of the patient before transfer is the key to avoiding complications during transfer. The aim of the Primary Survey is to identify and treat any immediate life threatening conditions and should be repeated frequently to detect any change in the patient's condition, so that resuscitative measures can be commenced immediately.

Key components of the Primary Survey are:

A – Airway control (with spinal immobilisation)
B – Breathing
C – Circulation (with haemorrhage control)
D – Disability
E – Exposure

Airway Control

Aim: to clear and secure the airway whilst maintaining spinal immobilisation where appropriate.

Causes of Airway Obstruction

May be complete or partial and occur at any level from the nose and mouth downwards to the trachea:

- Vomit, Blood, Foreign body
- Laryngeal obstruction (burns/inflammation) anaphylaxis
- Bronchospasm
- Bronchial secretions/pulmonary oedema
- CNS depression

Assessment and Observations

Patency of the airway may be assessed by:
Looking – for chest movement
Listening – for sounds of breathing
Feeling – for expired air

A conscious patient will complain of difficulty in breathing, may be choking or distressed. Partial airway obstruction will result in noisy breathing, strenuous respiratory movement, the use of accessory muscles and a 'see-saw' pattern of breathing. Complete airway obstruction produces silent respirations, with no air movement.

Management

Treat airway obstruction as an emergency and in most cases:

Simple airway opening manoeuvres are all that is required

- Head tilt
- Chin lift
- Jaw Thrust

Airway adjuncts

- Oropharyngeal airway
- Nasopharyngeal airway

Suctioning of the airway (be careful as patients with an intact gag reflex, may vomit, worsening the problem)

- Intubation
- Tracheostomy

Oxygen should be given to all patients at the highest possible concentration.

Breathing

Aim: to detect and treat life threatening respiratory conditions. A patent airway does not ensure adequate ventilation.

Causes of Breathing inadequacy

Breathing inadequacy may be acute or chronic and may be severe enough to cause a respiratory arrest, which will rapidly proceed to a cardiac arrest if not treated immediately.

- Respiratory drive – CNS depression may decrease or abolish the respiratory drive e.g. hypoxia, hypercapnia, hypotension, sedatives or analgesic drugs.
- Respiratory effect – Inadequate respiratory effect caused by muscle weakness or nerve damage occurs with many diseases e.g. myasthenia gravis, Guillain-Barré, multiple sclerosis and spinal cord injury. Breathing may be impaired by pain from fractured fibs.
- Lung disorders – Severe lung disease will impair gas exchange, causes include infection, COPD, asthma, pulmonary embolism, pulmonary oedema. Lung function is also impaired by a pneumo/ haemothorax. A tension pneumothorax causes a rapid failure of gas exchange, reduces venous return to the heart resulting in hypotension.

Assessment and Observations

a. Look, listen and feel for signs of respiratory distress e.g. sweating, cyanosis, use of accessory muscles.
b. Count respiratory rate. An increased respiratory rate is a warning that the patient may suddenly deteriorate.
c. Assess the depth of each breath, the pattern and whether chest expansion is equal on both sides.
d. Monitor SpO_2 (record inspired FiO_2). A normal SpO_2 in a patient receiving oxygen does not indicate adequate ventilation. The pulse oximeter detects oxygenation and not hypercapnia. Arterial blood gas measurement is required to assess adequate ventilation.
e. Listen to the patient's breath sounds. Rattling airway noises indicates airway secretions, inspiratory stridor or wheeze suggests partial obstruction.
f. Check the position of the trachea (sign of a tension pneumothorax), deviation to one side indicates mediastinal shift.
g. Feel the chest wall for signs of surgical emphysema; suggestive of a pneumothorax.
h. Percuss the chest, hyper-resonance is suggestive of a pneumothorax, dullness suggests consolidation or fluid.
i. Auscultate chest, bronchial breathing indicates consolidation.

Management

Treat breathing inadequacy:

- Give oxygen to all hypoxic patients
- Treat the underlying cause
- Non-Invasive ventilation
- Intubation and ventilation

Circulation

Aim: to detect and treat shock.

The circulatory phase of the Primary Survey consists of stemming any overt bleeding, assessment of the cardiovascular system and managing shock.

Causes

In almost all medical and surgical emergencies, consider hypovolaemia as the commonest cause of shock until proven otherwise. Unless there are signs of a cardiac cause e.g. chest pain, heart failure.

Assessment and Observations

a) Assess a central pulse e.g. carotid for rate, rhythm and character, a barely central pulse is suggestive of a poor cardiac output.
b) Is the pulse a bradycardia or tachycardia, is it bounding?

c) Measure the patient's blood pressure. NB even in shock the patients blood pressure may be normal due to compensatory mechanisms increasing peripheral resistance in response to a poor cardiac output. A narrow pulse pressure with a normal SBP is any early sign of shock.
d) Measure capillary refill time. (Apply cutaneous pressure for 5 seconds on a finger tip, with enough pressure to cause blanching. Time how long it takes for the skin to return to the colour of the surrounding tissues). A normal refill time is less than 2 seconds, prolonged time suggests poor peripheral perfusion.
e) Look for other signs of a poor cardiac output, such as reduced conscious level or a poor urine output.

Management

Insert a **minimum of two large bore peripheral cannula**

- Use short wide bore cannulae because they enable the highest flow (especially if blood and/or blood products are required).
- The antecubital fossa is the site of choice.
- If peripheral site is not available, then central venous access is advocated.
- Give a rapid fluid challenge of 0.5 to 1 litre of warmed crystalloid (e.g. Hartmann's) over 5 to 10 minutes. Then reassess and repeat if no improvement.

The above management should be modified in hypotensive patients where there is a definite bleeding source that has not been controlled e.g. leaking abdominal aortic aneurysm. In these cases vigorous fluid resuscitation will lead to further bleeding and worsen prognosis. Blood pressure is kept 20mmHg below the baseline; this is known as permissive hypovolaemic resuscitation.

Disability

Aim: to carry out a rapid assessment and begin treating any immediate life threatening neurological conditions.

Causes

The commonest causes of unconsciousness include profound hypoxia, hypercapnia, cerebral hypoperfusion due to hypotension or the recent administration of drugs such as sedatives or analgesic drugs.

Assessment and Observations

a) A rapid assessment of the nervous system is performed by checking the size of the pupils and their reaction to light.
b) Assessment of level of consciousness using AVPU
   A – Alert
   V – responds to Voice
   P – responds to Pain
   U –Unresponsive
c) In the presence of any neurological dysfunction, an assessment of the serum glucose is *mandatory*. If it is below 3mmols give 50mls of 10% glucose intravenously.

Management

- In the unconscious patient it is essential that the airway is cleared, secured and O_2 administered.
- Coma associated with hypoglycaemia should be treated as above.
- Naloxone/flumazemil should be considered if the patient is suspected of taking a narcotic/ benzodiazepine overdose.

Exposure

Aim: is to gain adequate exposure of the patient while keeping them warm.

It is impossible to carry out a comprehensive examination of the patient unless they are fully undressed. However, care must be taken to prevent hypothermia whilst maintaining patient dignity.

Chapter Three

Packaging Patients for Transfer

Introduction

Moving a patient from one location to another is hazardous regardless of the distance involved. The process must be approached with the same attention to detail as the resuscitation of the vital functions. Problems during transportation must be anticipated so that their impact may be minimised. The very process of transportation holds great potential for the level of care to deteriorate and each transfer must be treated individually. The transfer team must be self sufficient and competent in transfer and resuscitation skills.

Forward planning and careful attention to detail is vital. All patients should be suitably prepared whether it is for inter-hospital transfer by air, road or intra-hospital transfer.

The quality of care rendered en route is of vital importance to the patient's outcome. They should arrive at their destination point having received the best possible care, attention and intervention necessary.
For example:

Level 0-2

- Step up care, deteriorating ward patient who requires high dependency care.
- Attendance to x-ray or other department for investigation
- Transfer from ED to a ward or HDU
- Going to theatre
- External transfers, by road and air.

Level 3

- Ventilated patients inter and intra-hospital
- Tertiary requirements.

Packaging for all transfers: safety, comfort and skill.

Patients may be transferred for a numbers of reasons therefore the following principles apply to all modes of transfer.

Climate change should be noted and the patients should be asked, when appropriate, how warm they are before the journey is started. Please consider the air temperature changes which may be encountered

- being wheeled down a corridor
- into a lift
- manoeuvred into an ambulance

For these reasons patient should be warmly clothed, and covered in layers of blankets. It is better to have to remove blankets during a journey than to attempt to keep the patient warm by other means. Comfort, for any length of journey is important and particular attention must be given to patient needs.

Infusions should be minimised or when appropriate discontinued for the journey. Medical advice must always be sought and documented if infusions are to be temporarily suspended for a journey. Syringe drivers are the preferred device for precision infusion delivery and volume fluids delivered via giving sets and gravity driven. It is not advised to carry volumetric infusion pumps due to weight and ability to secure to meet CEN standards for the journey (more on this later). Remember, in transit they could become a missile.

All lines, tubes and drains must be safely secured in the approved manner with careful positioning to avoid pressure or obstruction. Transferring staff must have a good knowledge of prescribed drugs being used and those carried as emergency drugs for transfer. The transfer team should be aware of potential risks and adverse reactions of the drugs including the effects of absence.

All devices including ventilators and patient carriers must be firmly secured and meet CEN requirements of withstanding high impact of 10g and sudden deceleration. Therefore when in a vehicle road or air the transport device must be secured. For the road – the trolley must be secured via in-house locking mechanism; for air – the transfer splint must be secured by the air crew to housing on aircraft floor or raised patient platform (depending on which helicopter you are in).

Oxygen requirements must be calculated (see chapter 4, page 15) and communicated to ambulance and MCA S-92 crews before commencing the journey. It is the nurse's responsibility transferring intra-hospital to ensure there is sufficient oxygen for the journey between destinations.

Oxygenation must not be decreased for any reason unless directed by the parent team and clearly documented. Replacement and additional masks should be included in the transfer bag in addition to resuscitation equipment and airway adjuncts. Be aware of facts relating to oxygen cylinders, their size and capacity. Full oxygen cylinders have a volume of

- CD = 460 litres
- E = 680 litres
- F = 1360 litres

Consideration must be given to flow, capacity and length of journey. How long will the cylinder last. If additional cylinders are carried do they have the appropriate adaptor for use insitu? Where will it be stored? E.g. If a patient is on FiO_2 0.6 at 10 litres/min consider how long each cylinder would last.

Bed, Trolley, Ferno Splint or Vacuum Mattress.

All transport vehicles should be appropriately lined with bed linen as advised by local manual handling policy or manufacturer. Ferno Splint should be heated at least 30 min prior to the patient being positioned within it. It also provides spinal immobilisation and therefore comfort is of particular importance for these patients.

Security straps on the vacuum mattress must be tightened in sequence and the patient constantly spoken to, to ensure that over tightening does not occur. Ventilated patients must be monitored in the same way paying attention to airway pressures, tidal volume and expired minute volume when tightening the security straps and avoiding over tightening. The same principles apply to the Ferno splint and ambulance trolley.

Monitoring

Monitoring, equipment and resuscitation is covered in additional chapters however the message is ***K****eep* ***I****t* ***S****imple* and be *self sufficient* wherever you are wherever you are going. Patient and personal safety is the key. If equipment is absolutely necessary then it must be secured or it may become a missile.

Staff undertaking the journey must be familiar with equipment, the transfer bag and most of all, the patient.

Ready to go?
Are you **P.A.C.K.E.D**?

P Patient stable and comfortable on the trolley/vac matt/bed
A Assess the patient once you have made them comfortable. Record vital signs.
C Communicate with patient, make sure they are comfortable as they may be in that position for some time.
K Keep it Simple, don't take unnecessary equipment. Be self sufficient.
E Equipment including transfer bag. Do final check, ensure batteries are fully charged.
D Drugs and Discharge, Sufficient drugs for the journey and you are ready to leave.

Chapter Four

Minimal Monitoring: Equipment – "do's and don'ts"

Introduction

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.

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. Also there are shared risks for the transferring personnel and patient, the most serious being a vehicle fire or road traffic accident.

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 or helicopter.

Life-sustaining equipment such as replacement endotracheal or tracheostomy tubes should be part of your transferring equipment store. Whatever model of transfer ventilator one uses, 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 supplies.

Essential Monitoring

The level of monitoring for your patient will depend on the seriousness of their underlying condition (please refer to minimal monitoring standards page 12/13 Welsh Guidelines for the Transfer of the Critically Ill) and how clinically stable your patient is prior to the transfer.

Standard monitoring expected for any patient should include:

- ECG
- Oxygen saturation
- Blood pressure
- Temperature.

Any ventilated patient will <u>also</u> require capnographic monitoring because end-tidal CO_2 monitoring ensures there is a visual assessment of how effective your ventilation actually is with each ventilation cycle. End tidal CO_2 monitoring also acts as a visual disconnection monitor.

Oxygen requirements

Most transport ventilators are oxygen driven and depend on an oxygen supply to deliver the minute volume set by the user. It is essential that the medical staff involved in the transfer calculate the amount of oxygen required for the estimated duration of the transfer.

The amount of oxygen necessary for the transfer can be calculated using the formula:

Minute Volume (MV) x FiO_2 x time

MV: Tidal volume (Vt) x ventilator rate (per minute)
FiO_2: Fraction of inspired oxygen (e.g. 0.6 = 60% oxygen)
Time: Estimated time for transfer in minutes

Most authorities recommend taking double the amount of oxygen required to ensure that any unplanned delay will not compromise the patient safety.

Most oxygen driven ventilators will consume a small volume of oxygen each time it delivers a tidal volume. Although this volume is small (~50mls per ventilation), it should be factored into calculations for prolonged transfers.

The CD size oxygen cylinder is lighter than a standard C size cylinder, however it is designed to withstand higher pressures and thereby hold more oxygen. A full CD cylinder can hold 450 litres of oxygen when full. Most ambulances will have two HX size cylinders which can hold 2300 litres of O_2 when full. It is the responsibility of the transferring staff to confirm with the ambulance crew how full their cylinders are prior to departure. Ideally this should be done with the ambulance control before ambulance despatch.

Since the oxygen delivered to the patient is not humidified, it is *essential* to have a HME (Heat and Moisture Exchange) filter in place to protect the patient's respiratory system from dry gases. The filter will also protect the ventilator from any contamination from the patient. To ensure that a patient's tracheal secretions can be cleared effectively one needs to have suction catheters of the appropriate size available as well as a suction source.

Invasive Monitoring

The indication for invasive blood pressure monitoring depends on the stability of the patient. There are inherent problems with non-invasive blood pressure (NIBP) monitoring. These include:

- Vehicle/aircraft vibration can interfere with BP readings
- The cuff cycle for each reading can extensively use battery power of your monitor
- Acceleration and centripetal forces during vehicle movement will alter intravascular volume and can result in rapid swings in blood pressure which may not be recorded with NIBP.

There are practical problems associated with invasive BP monitoring which need to be considered with any transfer.

- The level of the transducer needs to be at the patient's mid-chest level, which needs to be visually confirmed whenever the patient is moved
- The pressure bag flush mechanism will contain air in the chamber of the giving set which may enter the flush line when the pressure bag is laid horizontally while transferring the patient. This may dampen the waveform trace or worse still, enter the patient's vasculature and lead to air embolisation.
- If the line isn't flushed effectively, then there is a risk that the line may stop functioning due to thrombus formation and thereby compromise your monitoring of your patient.

Infusion Administration

Inotropic support may be required due to the inherent disease process (e.g. sepsis) that the patient is suffering from at the time. Volume resuscitation will be necessary to offset the relative hypovolaemia that can occur due to changes in intravascular volume with acceleration, deceleration and centrifugal forces as a result of movement in any vehicle and aircraft.

Inherent problems when using syringe drivers for continuous sedation and/or inotropic support must be borne in mind when transferring any patient.

The combination of gravity and air entrapment in the syringe/infusion line can lead to "siphonage", whereby the contents of your syringe can empty without the plunger moving. This could lead to disastrous amounts of sedation or inotropes entering the patient's bloodstream. To avoid this risk, all infusion devices should be checked for air and lines tightly secured. The syringe driver should be secured no more than 80 centimetres above the level of the infusion site to avoid excessive gravitational influence.

Power Sources

Any patient monitors, volumetric pumps and syringe drivers will require a reliable power source. Battery power sources have a time span which may depend on the pre-existing state of charge and the demand on the monitor for power. Most commercially available batteries are of a Lithium ion structure. These may be removed, charged with a specific charging terminal and replaced by the user or they may be part of the internal structure of the device. Lithium ion batteries can be a fire risk due to overheating, if they are physically damaged when dropped.

An essential back-up is to have an inverter as part of your transfer equipment. An inverter converts direct current (DC) from the ambulance alternator into alternating current (AC) which will power the patient monitor and syringe drivers. Always remember to bring the electrical cable for your electrical device in order to plug it

into the inverter. The MCA S-92 and some of the *newer* land ambulances have direct access to (three-pin) plug-in AC power and inverters may not be required to access this power source.

Considerations

Securing the patient is paramount for a safe transfer. However, the security of the transferring personnel and equipment must also be considered. Your main consideration is what would happen in your vehicle should the ambulance crash. A moving oxygen cylinder will act as a potentially lethal missile when a vehicle crashes. Everyone is at risk in such a situation. Securing monitors, ventilators, syringe drivers and oxygen cylinders must be undertaken every time one enters an ambulance or aircraft.

Chapter Five

Intra and Inter-hospital Transfers; Bariatric, Level 0 and 1 Patients

Introduction

The object of this chapter is to introduce the key elements in the successful transfer of Level 0 – Level 1 patients within the hospital environment and between hospitals ("intra and inter-hospitals"). Particular attention needs to be given to the personnel and skills required, the necessary equipment and, as the paramount issue, the needs of the individual patient. The particular challenges involved in the transfer of bariatric patients require specific attention.

The following sections on the transfer of Level 0 – Level 1 patients, the personnel and skills needed, essential equipment and the treatment of the patient all apply equally to intra and inter-hospital transfers.

Transfer of Level 0 – Level 1 patients

Definitions – Level 0 patients are those whose needs can be met through normal ward care in an acute hospital

Level 0.5 patients' needs are similar with the exception that, because of confusion, they require two members of staff to accompany them on transfer

Level 1 patients are those at risk of their condition deteriorating, those recently re-located from higher levels of care and those whose needs can be met on an acute ward with additional advice and support from the critical care team.

Personnel and Skills needed

Level 0-0.5

The transfer can be delegated to a Porter or a Health Care Assistant (HCA) but if the patient is likely to be disorientated or confused (Level 0.5) the patient should be accompanied by two members of staff. The staff undertaking the transfer should have basic life support training as a minimum.

Level 1

The transfer should be undertaken by two members of staff, e.g. a Nurse or HCA and a Porter. Again, basic life support training for the members of staff is necessary in addition to training in the use of oxygen cylinders. However, depending on the condition of the patient, the Nurse or HCA must be competent in specific drug delivery, be able to recognise deterioration, and, if the patient has a tracheostomy, must be able to perform endotracheal suction.

Essential Equipment

Level 0-0.5

No specialised equipment is required.

Level 1

Some or all of the following equipment will need to be in place prior to transfer. The patient's needs must be assessed in order to decide on the particular equipment required in each individual case:-

- Oxygen and Pulse Oximetry
- Portable Suction
- IV Stands
- Infusion Pumps and / or Syringe Drivers

Treatment of the Patient

It is crucial to remember at all times that the patient's needs are paramount.

Safety - To ensure a safe transfer, as already stated, properly trained staff and appropriate equipment need to be deployed, on the basis of the individual patient's needs. For example, when transferring patients in their own bed, bed restraints (cot sides) should always be used.

Comfort – Unless there are clinical reasons (e.g. spinal injury) the patient should be *upright*, appropriately dressed to maintain their dignity and adequate bedding to ensure warmth and comfort.

Explanation – The patient needs to understand the reason for the transfer – e.g. moving to another ward or to another department for diagnostic procedure or treatment.

Ambulance Transfer

Ambulance Transfer is clearly only required for inter-hospital transfers. The transferring ambulance should be a High Dependency Service (HDS) Vehicle and the ambulance personnel will assume the role highlighted above for the porter. Level 0.5 and Level 1 patients must be accompanied by a HCA or a Nurse.

Bariatric Transfers

Bariatric patients are becoming increasingly common in line with trends within the general population. Therefore, the particular requirements for transferring these patients need to be addressed.

Intra-Hospital Transfers

The equipment used for these patients will be larger than the standard hospital equipment. Therefore, a bariatric bed may need to be adapted in order to be accommodated within a hospital lift, such as deflating side air cushions prior to transfer. It may be necessary to use the Critical Care Transfer (Ferno) Trolley since this has extendable sides.

Inter-Hospital Transfers

Bariatric patients can be transferred in an Urgent Care Service Vehicle as the floor locking mechanism can be moved to the middle of the ambulance. This means that both sides of the Critical Care transfer trolley can be extended allowing extra room for the patient.

Summary

Think before you start – What's the level of the patient?
Think before you start – Do we have the right staff and equipment?
Think about the Patient – Safety / Comfort / Explanation

Chapter Six

Transfer Personnel, Training, Quality Assurance; Audit and Documentation

Introduction:

Critically ill patients are transferred between hospitals for three main reasons:

- The need for tertiary care,
- The availability of Critical Care beds (or sometimes equipment e.g. CT scan, MRI)
- The repatriation of patients.

There are more than 650 critical care transfers each year in Wales. For the last few years we have been auditing all of these transfers for quality and safety. The information obtained from this auditing has been used to support the ongoing learning process to improve the quality of care for future transfers.

Personnel:

The transfer of critically ill patients should be undertaken by two attendants, usually a doctor and a nurse or other appropriate health worker. Both attendants should be suitably experienced and should have received training in transfer of the critically ill.

The precise requirements for accompanying personnel will depend on each clinical circumstance.

All personnel should be willing to undertake the transfer and should be able and prepared to work independently, as communication during the transfer may be difficult. All attendants should be able to work while in motion (i.e. they should not suffer from severe motion sickness).

Both should be familiar with the patient's history and current condition, in order to anticipate potential problems during transfer and to competently handover at the receiving unit.

Level 3 Transfers:

By definition Level 3 patients are intubated and ventilated. The accompanying personnel must be a doctor or, in some circumstances, Advanced Critical Care Practitioner (ACCP). Accompanying them there needs to be a suitably trained Operating Department Practitioner (ODP) or nurse.

Attendant 1:

Ideally this should be a senior doctor (Consultant / Associate Specialist / Staff Grade) who is trained in critical care medicine but, for stable patients, may an ACCP. Both doctors and ACCPs should be suitably experienced as outlined in the Designed for Life Guidelines for Transferring the Critically Ill Adult. They should also be familiar with the transfer equipment (see below) and know how to set up and use the transport ventilator and how to change oxygen cylinders and batteries or use an alternate power supply.

Attendant 2:

This should be a health professional with at least two years experience of working in a critical care environment (ICU / ED / Theatres). They maybe:

- ICU Nurse
- ED Nurse
- Anaesthetic Nurse
- ODP

In addition to 2 years critical care experience they should:

- Be willing to undertake the transfer
- Be prepared to work independently and assist in any necessary procedures
- Have basic airway skills (bag & mask ventilation)
- Be an ILS (ideally ALS) provider

Both attendants must be familiar with the transfer equipment (for more detail refer to chapter 4):

Ventilator - Capable of changing oxygen cylinders and batteries

Monitor - Know how to set up and be familiar with its functions

Infusion Pumps - Be able to set up and change infusion rates, change syringes and change batteries where required.

Be familiar with the content and the layout of the transfer bag

Be familiar with patient packaging and also know how to use the Transfer Trolley.

Be familiar with communication protocols and have contact details for both the transferring and receiving units.

Be familiar with handover procedures.

Air Transfers:
Both attendants must be suitably experienced. The transfer must be conducted by a senior doctor.

In addition to the above competencies the attendants must have received specific training in Air Transfer. They must have attended a Search & Rescue Station for aircraft familiarisation and safety training.

Level 2 Transfers:
The patient should be accompanied by two attendants, ideally a doctor or ACCP and an ODP or nurse. However this can vary according to individual clinical circumstances.

Medical attendant:
Either an anaesthetist, or other doctor/ACCP, who is competent in basic airway skills.

An anaesthetist is not required if:

- An airway problem is not anticipated
- The patient has a DNAR order
- Intubation & ventilation would be of no benefit.

ODP/Nurse:
As for Level 3 transfers.

Documentation:
It is important to keep a record of events around the transfer of a critically ill patient – this is your legal record of transfer. This should include:

- Patient demographics
- Diagnosis
- Who arranged the transfer
- Who is accepting the patient
- Who is accompanying the patient
- The patients condition prior to transfer
- Equipment and monitoring used.
- Observations during the transfer
- Drugs administered during the transfer
- Any untoward incidents during the transfer and how they were dealt with
- The patients condition at handover
- Any other relevant information

All this information is recorded on the All Wales Transfer Form.

Quality Assurance & Audit
As part of Clinical Governance and patient safety it is essential that the conduct of critical care transfers is reviewed. The yellow copy of all transfer forms is sent to the NWCCN who lead on monitoring critical care transfers for all Wales. An audit clerk is employed for this task.

All forms are analysed and are graded as follows:

- % of data fields completed (fields are weighted according to importance)
- All transfers are then graded as
  - Excellent

- Good
- Borderline
- Poor
- Uninterpretable (Unable to read the form)

All data is then fed back to each Regional Network Lead on a monthly basis. All transfers grades are feedback but transfers graded as poor are returned to the relevant Network for investigation and any necessary action.

The aim is to monitor transfers and raise the standards through a continuous learning process.

Chapter Seven

Specialist Transfers; Neuro, Spinal and Burns Patients

Introduction:
This section of the handbook and course is not designed to provide detailed knowledge of how to treat and care for patients with severe brain, spinal or burn injuries but more to provide a concise précis of how to move a patient with specialist requirements to a tertiary unit. Polytrauma patients will not have isolated injuries but it is important to apply these principles for such patients.

Time Pressure:
For good reasons, the principles of general transfer management tend to stress avoidance of haste.

However, if a need for urgent surgery is identified, for example a patient with an extradural haematoma) then a generally held neurosurgical principle is that outcome is improved if surgery takes place within four hours of injury (this is also supported by the NICE Guidelines). In hospitals relatively remote (in UK terms) from a neurosurgical centre, this can present a challenge for staff involved in these patients' initial management, but can still be achieved provided the pre-hospital phase has not been prolonged, and all staff focus on the task in hand.

Head Injuries - Initial Management:
It's not the place of a course like this to offer comprehensive advice on how to manage head injuries, but clear management of key decisions are vital in both immediate prevention of secondary brain injury, and in reducing the time to definitive surgery:

GCS 8 or less – Secure Airway
A is for Airway *with cervical spine protection*
Rapid Sequence Induction unless specifically contra-indicated
Treatment of *life-threatening* extra-cranial injuries *before* transfer

Similarly, a simple and well practised approach to lines, monitoring, sedation and ventilation technique pays dividends:

Lines:
- **2 x peripheral** (CVP lines are not usually time-efficient but may be required if the patient is hypotensive and requires MAP supporting)
- **Arterial**

Monitoring
- **ECG**
- **SaO_2**
- **$ETCO_2$**
- **IBP**
- **Temp**
- **Urine Output (Catheter)**
- **Pupils**

Technique:
- **Propofol/Opiate by infusion**
- **Relaxant - preferably by infusion**

Volume control ventilation (IPPV / SIMV) on transport ventilator
Hand ventilate for short periods only (to avoid fluctuating $PaCO_2$)

Targets:
- As an initial stabilisation goal:
  - **SaO_2>95%**
  - **$PaCO_2$ 4 – 4.5KPa, $ETCO_2$ ~ 4**
  - **MAP 80mmHg**

Scanning:
Start thinking about CT as soon as a major head injury is suspected. As soon as the initial primary survey and stabilisation have been undertaken, then transfer to scan. Be firm with the radiologists about the urgency of the situation. Transfer the images to the trauma/neuro unit immediately – don't wait to speak to the Trauma Team Leader (TTL) or neurosurgeon first.

Don't forget other important neurology. CT the C/spine unless it has been possible to clear it clinically.

Referral:
Contact the TTL (or neurosurgeon depending on local pathways). Once they have seen the imaging agree a plan and urgency of transfer. Be clear whether this is for immediate surgery, or for supportive ICU care and monitoring, as this will determine the urgency of the transfer.

Transfer:
Ring Ambulance Control and ask for either an IMMEDIATE transfer (if urgent surgery planned) or an URGENT transfer (if not) – see page 8.

Package and prepare the patient according to guidelines (see chapter 3).

Telephone the receiving hospital just before leaving. This will allow them to work out an ETA.

Avoid over-stressing the urgency of the situation to the crew. Heroics seldom save much time and greatly increase the risks to those on board the vehicle. Nevertheless, it's justified to avoid wherever possible coming to a halt at red lights and in road works.

For time critical transfers helicopter transfer may be useful. Bear in mind *total* time however i.e. time to mobilise helicopter, time to helipad, flight time and time from helipad. Consider using the Emergency Medical Retrieval Transfer Service (EMRTS Cymru), but again do not delay your transfer overall time by waiting for a heli-transfer.

During the transfer, observe and record pupil reaction at the same intervals as other vital signs.
NB: If a pupil fixes and dilates contact the TTL/neurosurgeon immediately by mobile phone for advice.

Spinal Injuries:
Patients with spinal injuries fall into two broad groups:

- Acute: for emergency surgery; often with associated head and/or polytrauma.
- Delayed: To Major Trauma Centre or regional spinal injuries unit for stabilisation and rehabilitation.

The primary considerations vary; acute patients may have unstable C-spine and airway issues. Delayed patients may well be awake. Either way, despite obvious concerns about stabilisation of the spine, spine boards should *never* be used for secondary transfers. Vacuum splints offer equally good stabilisation with less pressure area issues.

Burn Injuries:
It is easy to get distracted by the sight of a big burn. Bear in mind however that the patient may have other life threatening injuries. Early hypovolaemia will *not* be due to the burn; check the patient for bleeding.
Airway:

- If in doubt intubate - Do not cut the ETT
- Remember spine immobilisation
- Head tilt up if possible (this may mean tipping whole trolley)

Breathing:

- Consider smoke inhalation, blast injury (haemo/pneumothorax) and restrictive effects of circumferential burns to the chest and abdomen.

Circulation:

- Obtain *central* line access
- Look for a cause of early hypovolaemic shock as this will not be due to the burn alone.

Disability:

- Analgesia
- Blood sugar (big metabolic demands)

Exposure:

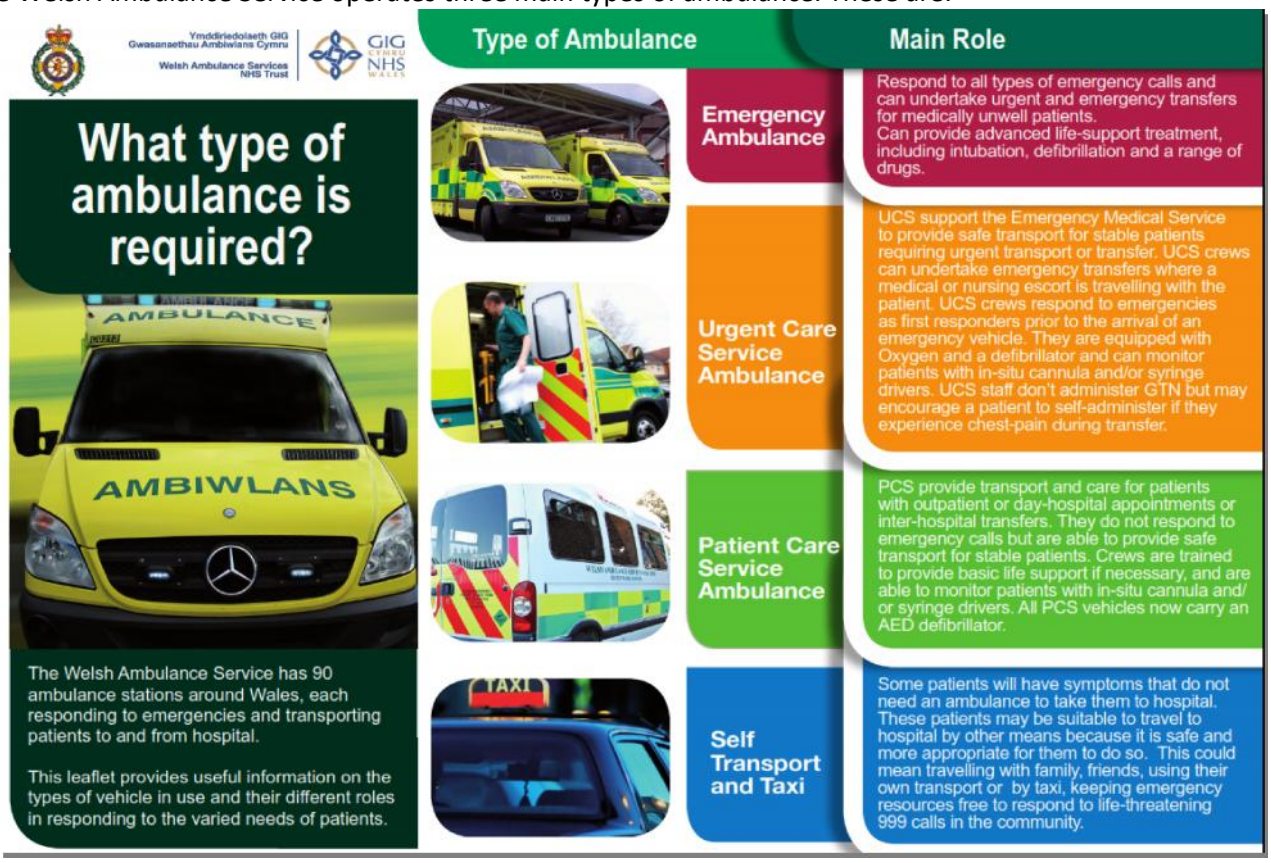
- Keep patient warm
- Cover wounds (cling film is useful)

Chapter Eight

Ambulance Orientation

Introduction

The Welsh Ambulance Service operates three main types of ambulance. These are:



Ambulance Orientation

The patient is placed upon the vehicle offside, head forward in the space. The ambulance attendant sits at the patient's head, as this seat also has access to vehicle switchgear and radios.

There is room for two passengers, who must be strapped into the seats on the near side of the vehicle when it is in motion. The primary clinician sits in the front seat and secondary clinician sits behind.

To leave the vehicle in an emergency, the back door opens outward, steps are deployed automatically. It is impossible to open the patient access door from inside the vehicle, due to the location of the external tailift.

To be rescued externally the small side door will be accessed and the ambulance crew will evacuate the patient using the tailift. However, to open the door yourself pull the door handle inward and push the door outward. Take care as it is a steep drop from the saloon floor.

Vehicle Equipment

All vehicles are equipped with a defibrillator/cardiac monitor that is capable of arrhythmia monitoring and 12 lead ECG monitoring. The unit also has built in SpO_2 monitoring. Some models have non-invasive BP monitoring. All EMS staff are trained in defibrillation, paramedics also have arrhythmia recognition and 12 lead ECG diagnosis skills.

Piped oxygen is available at a number of outlets throughout the vehicle and a Laerdal suction unit is fixed by the patients head.

The vehicles are fitted with personnel, patient and equipment restraints. It is important that these are used, as if the vehicle were to turn over in an accident, nothing in the back should be free to fall or move.

The publication of European Standards for ambulance vehicles, (CEN 1789) [Comité Européen de Normalisation] set out standards for safety which manes that all moveable objects have to be secured; non-compliance technically invalidates any EU ambulance's motor insurance policy.

Patient Loading

All patients are loaded onto the vehicle using the tail lift system. The Ferno transport trolley, used for all critical care transfers, is a direct swap for the normal ambulance cot. This means that it will fit into the standard floor mountings and does not require additional fittings.

The patient must be packaged appropriately (see chapter three). They are then loaded using tailift system to the offside of the vehicle; for *road* transfer monitoring must be on the patient's *right* side!

Summary

Critical care patients, transferred for whatever reason, should be transferred in a safe environment with competent, confident staff. Because critical care patients are escorted by hospital staff there is NO necessity for paramedic crews; technician staff are trained to defibrillate if ever the need arises.

As escorting personnel it is important to orientate yourself to the ambulance environment to transfer both you and your patient safely. Whilst you need to be 'self sufficient' your ambulance crew will have an extensive knowledge of the inside placement and workings of the ambulance.

Chapter Nine

Legal and Ethical Issues in Transferring Critically Ill Patients

Introduction

The first duty of a doctor must be to ensure the wellbeing of patients and to protect them from harm. Patients expect doctors to be technically competent, open and honest, and to show them respect. By demonstrating these qualities, doctors earn the trust that makes their professional status and privileges possible. Therefore doctors and other healthcare professionals involved in the transfer of critically ill patients have to consider both the ethical and legal consequences of their actions and decisions.

Many doctors are unsure of their roles and responsibilities in their interactions with the legal system. This is not surprising, given the increased requirements imposed on medical practitioners by legislation, regulations and guidelines. A medical practitioner has a number of legal responsibilities covered by various pieces of legislation. These range from diverse legal responsibilities such as signing death certificates to detaining psychiatric patients. The NHS is founded on and continues to be developed by statutory laws. The medical profession in the United Kingdom first emerged through the medical royal colleges in 1505. The 1858 Medical Act united the medical profession and created the General Medical Council (GMC) - a structure through which the profession could develop an ethical code, systematise education, and punish erring members. The council derives its authority from parliament; its membership includes 40% of lay members.

The GMC registers doctors to practise medicine in the UK. The GMC's main role is to protect, promote and maintain the health and safety of the public by ensuring proper standards in the practice of medicine. Under the *Medical Act 1983* the function of the GMC is:

- keeping up-to-date registers of qualified doctors
- fostering good medical practice
- promoting high standards of medical education
- dealing firmly and fairly with doctors whose fitness to practise is in doubt.

The maintenance of the official register is a basic function of the GMC, the purpose being to protect the public from those who have not undergone recognised training. In the UK there is no specific offence in an unqualified person practising medicine but there is an offence of pretending to be a registered medical practitioner. Registration does not provide a positive entitlement to practice; an additional licence to practice is also required. Revalidation will ensure a practitioner's fitness to practice by means of evaluation.

The regulatory function of the GMC is now increasingly provided by lay-persons. The concept of 'professionally-led regulation in partnership with the public' enables the GMC to set a framework of standards and ethics that are owned by the profession while reflecting the views and expectations of the public. The values are embodied in the publication *Good Medical Practice*, which underpins all the GMC's work.

Doctors must be aware of their legal responsibilities and these must be dealt with in a professional manner. A doctor's best protection against falling foul of the regulatory bodies relies on the following points of good practice:

1. effective communication with patients, their families and other healthcare providers
2. staying up-to-date clinically
3. realising and practising within the limits of your skills, knowledge and experience.

There is an automatic legal duty of care whenever a healthcare professional accepts a patient to treat. This does not automatically mean the patient is entitled to everything they demand. But there is the question of a standard of care a patient is expected to receive. In the case of the critically ill patient who needs transfer, the stabilisation or on-going critical care treatment has already established a duty of care with the healthcare professionals taking care of the patient. That duty of care cannot be discharged until there has been an effective handover to another clinician.

The degree of expertise possessed by a medical practitioner depends on his experience and training and arguments have been put forward that the standard of competence of a newly qualified doctor will be less than that expected of an experience practitioner. However the *Bolam* principle does not allow that assumption because it is an objective standard and therefore irrelevant when the doctor qualified. It is therefore very important when selecting healthcare professionals to transfer critically ill patients that those with adequate experience and training are selected. Equally healthcare professionals should not accept the duty of care of transfer if they are not suitably trained.

Critical care is in an emerging crisis of conflict between what individuals expect and the economic burden society and government are prepared to provide. The goal of critical care support is to prevent suffering and premature death by intensive therapy of reversible illnesses within a reasonable timeframe.

Triage decisions are affected by capacity, and mortality is affected by the decision to permit or refuse admission to the ICU. Physicians are often placed in a troubling conflict of interest by pressures to use health resources prudently while also promoting the equitable and timely access to critical care therapy. Thus in the relative shortage of critical care beds transfer of critically ill patients has become one of the ethical decisions that a frontline clinician has to make from time to time.

Ethics

The modern era of medicine has taken on board the principles of autonomy and the paternalistic practices of old are disappearing from the doctor-patient relationship. Thus the public demand a voice in the technological advancements and the provision of healthcare. Traditional medical ethics focused on the professional ethics of physicians; today bioethics has a broader remit acknowledging the interplay of the ethics of sociology and culture. The traditional ethical basis of Western medicine is characterised by a number of rules and moral codes. The GMC's *Good Medical Practice* is an example of this deontological code, which sets the standards of the duties and responsibilities of doctors in the UK. The great strength of the deontological tradition is its stress on the autonomy of patients and the primacy of the doctor-patient relationship.

The necessity for rationing of healthcare resources brings utilitarian analyses into particular prominence. This has a significant bearing in the debate on the scarcity of critical care beds and the need to transfer critically ill patients when there are no available beds. Beauchamp and Childress (2001) recommended four "clusters" of moral principles that have become the basis of medical ethics. The four are;

- respect for autonomy;
- non-maleficence [do no harm];
- beneficence [doing good]
- justice [promoting fairness].

This approach has become to be known as principilism. The authors suggest that the clusters do not provide a moral theory but *"provide only a framework for identifying and reflecting on moral problems."* Using these principles clinicians can make morally justified decisions in difficult clinical dilemmas such as the transfer of critically ill patients due to the lack of critical care beds.

Chapter Ten

Transfer by Helicopter

Introduction

Across Wales, for time critical transfers or patient highly likely to deteriorate, we have the option of requesting a transfer from EMRTS. If appropriate and agreed EMRTS will package and transfer the patient without the need for hospital staff to accompany the patient. A full handover therefore needs to be given to the EMRTS team.

If EMRTS cannot assist for whatever reason be it weather, timings, already deployed, it may be necessary to request a transfer by the Maritime and Coastguard Agency (MCA) S-92 helicopter. A request for patient transfer by this Search and Rescue helicopter will only be granted if no alternative/suitable means are available; this includes commercial/civilian air ambulance. In order to maintain operational readiness and availability, the SAR crew are not obliged to return medical staff to their home place of work/hospital; however, in most cases they will endeavour to do this.

The advantages to using the S-92 helicopter over a land ambulance/civilian air ambulance are:

- Speed, for example flying times from: Bangor hospital to London – 1 hour and 40 minutes; Aberystwyth to Leicester – 55 minutes.
- Space: The aircraft can easily accommodate up to four medical staff, plus the patient and all necessary equipment.
- The aircraft can fly in pretty much all weather conditions, day or night (pending certain extremes).

However, with all advantages, there has to be disadvantages, or should we say, considerations:

- The back of a helicopter, especially at night, is a very unfamiliar environment for most and can often distract them from their primary task i.e. caring for the patient.
- Helicopters are noisy and can vibrate, making communication and patient monitoring/ assessment difficult.
- Air sickness can be a factor for some and can be quite disabling.
- The aircraft could, at any stage, be diverted off to a higher priority life saving task, although, this is not common.
- Unlike EMRTS as hospital team is required to accompany the patient (which may leave staffing short in the base hospital.

Preparation - General

Try EMRTS first.

Once the decision has been made to employ the use of a SAR helicopter for a patient transfer, consideration should be given to who and what needs to travel with the patient. As a rule, only the minimum number of staff required should accompany the patient, and ideally, they should be familiar with helicopter transfers and suitably qualified. The S-92 carries equipment comparable to a land emergency ambulance (ALS capable) and the Rearcrew are medically trained (normally a Paramedic and Technician).

Inform Ambulance Control/the control authority of the number of staff, patients who will be required to fly. A standard level of equipment will be assumed by the crew however, if you will be carrying or using any specialist equipment i.e. a balloon pump/incubator, ensure that this information is passed on. If you have any doubts about whom or what can be carried, do feel free to contact the allocated SAR crew directly; Ambulance Control should be able to obtain the number easily. If you have any special flight requirements, again, talk directly to the crew. Communication is the key to a smooth transfer.

Preparation - Patient

The Ferno or Vacuum Splint is the ideal transport medium for the helicopter. Ideally in order to ease loading and unloading, the patient and equipment should be packaged in such a way that they are one, self contained unit. IV lines and ET tubes should be well secured with all access preferably on the patient's right side.

Avoid loose, dangling tubing, IV lines etc – they will inevitably snag on something. Ensure that all of your equipment, monitors, syringe drivers etc have sufficient battery power for the journey, plus a reserve. Carry adequate medications, fluids and gases for the patient's needs, plus an emergency supply of essentials in case of delays or diversions.

Preparation – Accompanying Medical Staff

When flying in a helicopter, arms and legs should be covered at all times, so no t-shirts or scrubs. Wear clothing that is appropriate to the weather but bear in mind temperature falls with altitude. It may be warm and sunny from where you depart, but could be cold and wet at your destination and you could be out for a long time. A pair of gloves, a warm hat and a warm, waterproof jacket is a good idea at most times of year in the UK.

Not all helicopter landing sites are purpose built, some are located in muddy fields, so wear appropriate footwear. The crew will provide you with a headset to allow you to communicate onboard the aircraft – they will brief you on fit/use.

Remember the back of the aircraft is nothing like your normal working environment; space is restricted, the patient will be a raised platform and your equipment will be stowed in bags secured around the aircraft cabin. In order to operate effectively in this environment, all equipment should be organised well and kept tidy and you need to be familiar with it; a dimly lit aircraft cabin is no place to be searching for that lost ampoule when the patient has taken a turn for the worst. A personal head-torch is recommended, this will help you to clearly see what you are doing while keeping your hands free.

Most important of all, it is suggested that you carry a mobile phone (with useful numbers), some cash and a credit card. These may all come in handy when the helicopter has to quickly drop you at the receiving hospital and departs off on another, more urgent task.

The Transfer – Loading the Helicopter

Do not approach the helicopter unless cleared to do so by the crew.

The patient should only be brought to the helicopter if they are in a *stable* enough condition for the flight. They should be correctly packaged and all appropriate necessary equipment should accompany them at all times. This is not the case for ALS resuscitation equipment, which the S-92 is equipped with and will be employed for any complications. This includes the utilisation of spare oxygen if required for delays or diversions. As discussed earlier, the patient and equipment should be packaged in such a way that they are one, self contained unit for ease of loading onto the helicopter. Do not forget the ambient temperature when preparing the patient. It has not been unknown for the patient to be wheeled down the road in the snow and rain with nothing but a sheet to protect them! Would you be happy?

The S-92 winchman will approach you; the team leader should identify himself and provide a clear brief on the patients needs, equipment to be carried and any special circumstances. The helicopter Rearcrew will control the loading of patient and equipment on to the helicopter. Take extreme care when the stretcher is being loaded as IV lines and O_2 tubing can very easily become snagged, resulting in loss of IV access or displacement of ET tubes. The Rearcrew will ensure that all equipment is correctly stowed and secured and will fit and brief you on head-sets.

Now is the time to double check that you have got everything you need, the patient is stable and that you are happy with the helicopters nearest emergency exits, your seat belt and use of the intercom. If it's dark, or light is fading, have you got your head-torch to hand? Don't forget the patient's notes!

The Transfer – During Flight

Sometimes there will be nothing more to do than sit back and take pleasure in the view.

Flying in a helicopter can make monitoring the patient difficult. Pulses are difficult to palpate, a stethoscope is no use to you at all and you cannot always communicate freely with the patient (dependent on condition, the patient can be fitted with a head-set if required).

At night, when the crew are using Night Vision Goggles (NVG's), the cabin lighting will have to be dimmed. This is where your head-torch will come in useful for writing up the patient's notes or preparing drugs etc.

Movement about the helicopter cabin is permissible, just ask the crew first. They will always expect you to be strapped in for any take-offs/landings. However, movement and access to the patient will be difficult so take care at all times; watch where you are standing and move carefully.

The Rearcrew will gladly assist you at any time although in very poor weather, the whole crew may be occupied with the safe operation of the helicopter. If you need something though, do not be afraid to speak up on the intercom or attract one of the Rear crew's attention – after all, they are there for the patients needs.

The Transfer – Unloading

Do not exit the helicopter until directed by the crew. As with loading, take great care when unloading the patient, in particular watch out for loose tubing and IV lines. Double check that you have everything – especially the patients notes!

Be flexible, the receiving ambulance or unit may not be familiar with your stretcher and/or equipment. Some Ambulance trusts may refuse to lift the stretcher from the aircraft – it has been known!

Discuss, before dashing off to the receiving unit, the viability of the return journey. Whatever you estimate your handover time to be – double it! The crew will inform you if there are time constraints or other factors that could affect your 'lift home'. They may elect to use the handover time to refuel the helicopter at a nearby airfield, in which case they will brief you how long they will be. If they have to depart for another task, ensure that you have all your equipment and possessions with you. This is where the cash and mobile phone will come in handy!

Contingencies

Always try to have an alternate plan in mind – consider the 'what if's?'

- What if the helicopter did not turn up because it was unserviceable or called to an emergency?
- What if the patient's condition significantly deteriorated in flight?
- What if the helicopter had a problem during the transit and had to divert to an alternate airfield – would you have enough drugs, battery power to cover the delay?

The time to think about these things is not when they happen, discuss them with your colleagues over a coffee or express any concerns to the crew.

Above all, the helicopter is a fast and efficient method of transport that can speed the critically ill patient safely and, with the complete support of a full transfer team and equipment, to definitive care.

Transfer of the Critically Ill Course - Part B

This part of the course is designed to demonstrate practical knowledge of the equipment used in your hospital and should be delivered in small groups of no more than 12 delegates. It should take half a day and at the end of it you should be able to demonstrate the following skills. For staff transferring Level 3 patients **all** skills must be demonstrated. For those staff transferring Level 2 patients e.g. cardiac catheter lab and Coronary Care staff the first section must be completed.

Delegate's name:			
	Date:		
Skill	**Pass**	**Defer**	**Signature**
	Please tick		
All Staff – Level 2 and Level 3 Transfers			
Transfer Trolley			
Demonstrate safe packaging of the patient on the trolley			
Demonstrate safe mounting of equipment onto the trolley			
Show how to change oxygen cylinders			
Demonstrate all other functions on trolley			
Splint system for air transfers			
Demonstrate how to package a patient onto the vacuum mattress			
Demonstrate how to safely attach equipment onto the vacuum mattress			
Transfer bag			
Look through contents of transfer bag, familiarise and discuss			
Transfer Monitor(s)			
Show how to zero invasive waveforms			
Ability to set up ECG			
Ability to set up pulse oximetry			
Infusion Pumps			
Have knowledge of battery limitations and show ability to attach to ambulance power supply			
Ability to change syringes			
Ability to give boluses and change pump settings and rates			
Miscellaneous			
Demonstrate use of CD oxygen cylinders			
Demonstrate use of other types of oxygen cylinders			
Ability to calculate oxygen rate of consumption			
Explain rationalisation of drugs			
Discuss management and safety of chest drains during transfer			
Staff undertaking Level 3 Transfers			
(Transfer) Ventilation			
Ability to perform pre-transfer check			
Demonstrate capnography set up			
Demonstrate good knowledge of ventilator modes and settings			
Knowledge of battery limitations and show ability to attach to ambulance power supply			
Ability to change oxygen cylinders and attach to ambulance oxygen supply			

Assessor's name:..... ... Assessor's signature:.....

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