

# Interhospital and Intrahospital Transfer of the Critically Ill Patient

T K Tan

## ABSTRACT

**Aim:** This paper highlights hazards involved in moving critically ill patients between locations, discusses minimalisation of risks involved and the advantages of specialist teams.

**Method:** This is a systematic review.

**Results and conclusions:** Critically ill patients are moved within the hospital because of the need for surgical procedures or to have fixed facilities investigations performed.

Interhospital movement of patients is necessary for specialised care available elsewhere. This has increased with centralisation of specialist services.

This paper adopts a practical approach to the transfer process. It establishes the goals of conducting a safe transfer, highlights the deleterious effects of moving an ill patient, the risks and pitfalls of a transfer, and how to minimise them.

Attention is drawn to the need for proper resuscitation and stabilisation of a patient before transport. The quality and outcome of the transfer depend on the experience of the transferring team and on adequate monitoring facilities.

The benefits of a specialist transfer team is suggested.

**Keywords:** interhospital transport, intrahospital transport, secondary transport, critically ill, specialist transfer team

## INTRODUCTION

Primary transport is the transfer of patients from the site of accident, injury or onset of illness to the hospital. Transfer of critically ill patients which takes place between locations within the hospital or between hospitals is termed secondary transport.

The receiving centre is usually able to provide a higher level of diagnostic or therapeutic care either by specialist staff, technology or equipment. Centralisation of specialist services in Singapore and intensive care bed shortages in Britain have resulted in more acutely ill patients being transferred between hospitals for appropriate therapy.

This article will discuss interhospital transport, then intrahospital transport.

## INTERHOSPITAL TRANSFER

### Aim of transfer

The chief aim of a transfer is one which is safe, meets the demands in changes in physiology and render appropriate treatment during the journey. The patient must not be any worse off than his original condition<sup>(1)</sup>. The standard of care during the transfer should commensurate with what the patient had or will receive<sup>(2)</sup>.

### The period of transport is one of potential hazard

This is a time of potential hazard to both patients and accompanying personnel and a period of physiological instability for the patient<sup>(3)</sup>. The Glasgow Clinical Shock Study Group's audit had no deaths in transit but the eventual high mortality led them to conclude that accurate prediction of patient's illness scoring is important to avoid an inappropriate transfer<sup>(1)</sup>.

Pitfalls to a safe transfer include inadequate facilities for transfer. The lack of experience in managing critically ill patients is a dominant factor in the development of complications during transport<sup>(4)</sup>.

### Minimising the risk of complications during transfer

The risks of transfer may be minimised with:

- attention to adequate stabilisation and resuscitation prior to transfer. Emphasis is placed on a smooth, slower journey with continued care<sup>(5)</sup>. The distance travelled may not be all that crucial. Bion et al's audit of critically ill patients being transported concluded that improved standard of resuscitation is needed prior to transfer<sup>(4)</sup>.
- attention to planning the transfer and monitoring<sup>(6)</sup> during transfer.
- attention to who actually conducts the transfer. Critically ill patients being transferred are best looked after by an anaesthetist or a person trained in intensive care. The escort assistant should ideally be from the Accident and Emergency Department or ICU trained<sup>(1,4,8)</sup>. Operating Department Assistants<sup>(9)</sup> by the nature of their job and as working associates of anaesthetists, are eminently suited as escort assistants.

Another option would be the use of a central retrieval team.

Department of Anaesthesia  
Glasgow Royal Infirmary  
84 Castle Street  
G4 0SF  
United Kingdom

T K Tan, MBBS, FFARCSI,  
FRCA  
Specialist Registrar

### Effects of transfer

Factors that contribute to the discomfort and hazards of travel include pain, noise, vibration, bumpy roads, turnings, accelerations and decelerations and up and down hill motions. These can contribute to significant cardiovascular changes.

Irrespective of the severity of illness, patients exhibit a cardiorespiratory response to transport<sup>(9)</sup>. As they may be peripherally dilated as a result of sepsis or drugs, they are even more susceptible to the cardiovascular system's response to acceleration and deceleration forces. Unless the patients are adequately volume replete, profound hypotension may occur even at low speeds<sup>(10)</sup>. Ridley and Carter's patients responded to transport with an increased mean arterial pressure and decreased heart rate. Hothersall et al showed that both hypotension and hypertension can occur after ambulance transport. There was transient hypertension and arrhythmia associated with sudden acceleration forces. These were minimised as the patient had been resuscitated adequately before transport and sedated effectively during movement<sup>(11)</sup>.

### What can go wrong during transport?

A multitude of transport related complications<sup>(12)</sup> include cardiovascular instability, accidental haemorrhage eg from dislodged cannulae, loss or blockage of chest drains and catheters, development of pneumothoraces and need for airway manipulation and enhanced oxygen therapy. Metabolic derangements like hypoglycaemia, hyperglycaemia and changes in blood pH can occur.

### Who does the transfer

A dedicated specialist transfer team serving the island or the region has the advantage of having performed frequent transfers and can offer a consistent and high standard of care<sup>(13)</sup>. They should be used for transporting unstable patients, even if the team may take a little longer to arrive or stabilise the patient, unless the transfer is for immediate surgical intervention.

Such a transport team should ideally be available for patients who

- a) have had a recent life-threatening event, even if now stable, but has a possibility of the event recurring eg following seizures with apnoea, or unstable cardiac rhythms.
- b) have respiratory conditions that may potentially deteriorate during travel eg asthma, croup or epiglottitis.
- c) if needing ICU care in the receiving hospital, must have a similar standard of care and monitoring during transfer<sup>(14)</sup>.

Highly trained teams include the Stanford University Medical Centre Transport Team and the Shock Team in the City of Glasgow. The Royal London Hospital has a Helicopter Emergency Medical Service.

These teams avoid unnecessary duplication of manpower and equipment and are available 24 hours.

They also provide training to resident medical staff in the exacting discipline of transferring critically ill patients.

The Glasgow Shock Team comprises several paired teams on a 24-hour rota with each member being a post-fellowship anaesthetist of at least registrar grade in seniority. At the transfer location, they may set up monitoring lines, insert chest drains when indicated or electively intubate a patient, to ensure a safe passage for the patient. They may institute therapy such as administration of inotropes, resuscitate and stabilise patients before transfer.

If a specialist transfer team is not available, the accompanying doctor and a suitably trained assistant must be proficient in Advanced Cardiac Life Support and airway management.

### The mode of transfer

The choice of transfer medium depends on the degree of clinical urgency, and road and weather conditions.

Local ambulances are readily available, inexpensive, mobile in most weather conditions and can stop if there is a procedure that needs to be urgently performed. Its drawback include susceptibility to traffic conditions and increased travel time with longer distances. Mobile intensive care or an ambulance modified for the transfer of critically ill patients, has the advantage of being better equipped. Aeroevacuation includes fixed wing and rotary wing crafts. Helicopters are invaluable for inter-island transfers eg military accidents on remote training islands. Though quick to respond, they are costly, limited by weather and the availability of landing sites. Monitoring patient's condition and emergency procedures are difficult to perform because of noise, vibration and movement.

### Equipment and drugs

An uncomplicated but efficient portable mechanical ventilator which delivers 100% oxygen and has PEEP facility is ideal. There must be adequate oxygen supply for the entire journey. Size E cylinders of oxygen have the advantage of being portable. Larger, spare oxygen cylinders are kept in the transport vehicle.

A useful monitor must be vibration-resistant, robust, compact, clearly visible and illuminated and have adequate battery power for the journey and beyond. It should be capable of multi-channel ECG monitoring and incorporates other monitoring modalities like temperature, invasive and non-invasive blood pressure monitoring, pulmonary artery and central venous pressures and end-tidal carbon dioxide and pulse oximetry, and would be even better if it has defibrillator capability.

Telecommunications availability is crucial to alert the receiving hospital, to seek police escort in difficult traffic conditions or even to seek medical advice.

Warm blankets, battery powered infusion pumps, a selection of crystalloids and colloids and extra venous cannulae must be available. Bottled fluid containers are at risk of breakage whereas plastic fluid bags are efficiently amenable to use with pressure bag infusers.

Equipment for airway management include laryngoscopes, a range of endotracheal tubes, self-inflating resuscitation bags, airways and a laryngeal mask. A battery powered suction apparatus is invaluable for clearing secretions and blocked endotracheal tubes. The transfer trolley which allows minimal number of trolley changes and flexible enough to be used in a range of vehicles is ideal. It should be light, spacious and robust to carry the necessary monitoring equipment, gas cylinders and infusion pumps.

A full range of resuscitation drugs is essential and other standard drugs like sedatives, analgesics and muscle relaxants, anti-convulsants and mannitol must be readily available in the transferring doctor's pharmacological armamentarium to meet anticipated needs.

All drugs and equipment must be periodically evaluated. Any lost, used or expired items must be promptly replaced.

### **Monitoring**

Monitoring for changes in the patient's vital signs<sup>(17)</sup> and providing continuous cardio-pulmonary evaluation should conform with the standards set by the Association of Anaesthetists of Great Britain and Ireland<sup>(13)</sup>.

Cardiovascular monitoring includes continuous electrocardiogram and blood pressure measurements. Invasive pressure monitoring is recommended since few devices give accurate non-invasive measurements when confounded by motion<sup>(20)</sup>. Unless a continuous pulmonary artery waveform is displayed, the pulmonary artery catheter, if present, should be withdrawn to prevent accidental wedging during transfer. CVP measurements may be required.

An airway pressure monitor and disconnecting alarm system must be available. The reliability of pulse oximetry is diminished if the patient is poorly perfused. Its accuracy may be affected by motion and vibrations. End-tidal carbon dioxide and intra-cranial pressure monitors may be needed for transferring patients with head injuries.

Temperature, urine output and any drainage fluids must be documented. Charts which document patients' physiological details during initial assessment, transfer and record interventions during the transfer process may be modelled after a standard anaesthetic monitoring chart. Details of time patients left referring hospital and time of arrival should also be included in the chart. There should be room for noting any additional details relevant to the transfer.

### **A checklist before departure**

Gentleman and Jennett's checklist before transferring head injury patients to a neurosurgical unit is similar to any critically ill patient being transferred<sup>(16)</sup>.

#### **a) Respiratory System**

If there is any doubt at all about the adequacy of the airway – the patients must be electively intubated. Mechanical ventilation is adjusted to maintain a partial pressure of oxygen and partial pressure of carbon

dioxide appropriate for the patient. An intubated patient ought to be sedated and paralysed for the transfer, to obtund harmful physiological responses to the presence of the endotracheal tube. An arterial blood gas sample is done prior to transfer, both as a baseline and as an assessment of the patient's status. A chest X-ray to ascertain tube and lines positions have to be performed and chest drains should be unclamped. Underwater seal drains with plastic reservoirs (to prevent breakage) should be placed well below the patient and secured from tilting.

#### **b) Circulation**

Reliable venous access must be established and intravenous cannulae and other invasive lines and their connections must be meticulously secured. The heart rate and blood pressure must be appropriate for peripheral perfusion. If there had been a haemorrhage, adequate resuscitation must be undertaken and haemostasis must be secured and the cause treated. If an inotrope is being delivered, a reliable delivery system and back-up device must be available. There must be enough inotropes to last until the transfer is accomplished. A set of recent full blood counts, coagulation screen and urea and electrolytes must be available.

#### **c) Injuries**

Patients with neurological presentations must have their initial Glasgow Coma Scale noted and the trend documented. Cervical spine injury and other spinal injuries must be excluded or treated if suspected otherwise. Fractures must be documented and splinted if a long bone is involved. Any thoracic, abdominal or pelvic bleed must be excluded and treated. Analgesia must not be left out.

### **Handing over to the receiving team**

Concise description of the clinical scenario, progress reports, transport details, any interventional procedures and information on drugs and fluids administered and relevant documentation are to be passed to the receiving team. If any laboratory results are still unavailable, and any urgent prospective investigations planned, the receiving team must be informed. A contact name and telephone number to call for more information must be supplied. Audit by the team involved helps establish or improve existing protocols to enhance the standard of future transfers.

### **INTRAHOSPITAL TRANSFER**

Although some workers feel that intrahospital transport of critically ill patients is relatively safe using established transport protocols and carries a low risk of detrimental complications<sup>(12)</sup>, few would doubt that there is significant potential for misadventure<sup>(3)</sup>.

Discussion in this section is centred around CT scanning as a representation of any diagnostic or therapeutic procedures that would involve movement of a critically ill patient. The bulk of intrahospital movement of patients involve movement between the Accident and Emergency Department and ICU

or Radiology Department and ICU and Radiology Department or operating theatres. Many ICU patients have a greater need for intrahospital movement because of the nature of the disease processes eg staged procedures for trauma, surgery for gastrointestinal bleeds or drainage of abscesses. Many require imaging procedures at fixed facilities.

#### **Stabilisation of patient and organisation**

The basic principle of having a patient as physiologically stable as possible prior to movement is important. The anaesthetist is frequently involved in managing an unstable patient at the Accident and Emergency Department. Once a decision is made to take the patient to the ICU or for CT scanning, organisation is crucial, as any omission of simple tasks create unnecessary delays, which can be detrimental to the patient's condition.

Mundane tasks like contacting the radiographer, calling for porters, preparing infusions of drugs must be delegated and executed simultaneously. The CT-scan suite and team should be ready and waiting for the patient, not vice versa. It is not advisable for an intubated and ventilated patient to be left waiting outside the scan room.

Two porters must be available. It is not acceptable for the doctor or the escorting nurse to porter as this distracts them from patient monitoring.

#### **Drugs and equipment**

The accompanying doctor must be fully satisfied with venous access, especially so if sedative drugs are being infused. Adequate amount of sedatives and muscle relaxants and intravenous fluids must be brought, especially if the scan room is in a remote part of the hospital. Unexpected delays during scanning may result in the use of more than the expected amount of drugs.

A basic tool like the stethoscope is crucial if oxygen saturation falls during transfer. The availability of the ambu-bag and airway adjuncts are life-saving measures in the event of endotracheal tube damage or blockage, or accidental extubation. Extra endotracheal tubes and intubating equipment must be available. The oxygen cylinder and a spare cylinder must have enough reserve for the trip and during the procedure. It is crucial to be familiar with knowing how to open the oxygen cylinder. The monitoring system, transport ventilator and oxygen sources must be checked daily by a dedicated team, ideally the ICU staff, and to ensure that all the battery systems are duly charged. There is no scenario more distressing than having the battery supply of the monitors running out in the midst of a transfer.

#### **Set up in the scan room**

Upon arrival at the scan room, the ventilator is connected to a wall oxygen source and monitors, to a wall socket. This is to preserve supply for the return trip. Transferring the patient between the trolley and the scan table is tedious and time-consuming because

of the many cables and infusion lines and pumps, which have a propensity to get entangled despite efforts to prevent it. Systematic attention to these ensures no loss of crucial venous access, kinked infusion lines or having pumps switched on or off unintentionally. The monitors should be positioned such that it is clearly visible from a safe distance from the ionising radiation. Magnetic resonance scanning would require a wholly different equipment setup<sup>(18,19)</sup>. All the monitoring cables and intravenous lines must have enough slack to allow for movement of the scanning table.

When the results of the investigations are known, quick communication with relevant specialties like neurosurgeons or Intensive Care Unit for a further plan allow other forward planning like activation of a transport team and even simply calling for the porters.

#### **CONCLUSION**

Movement of critically ill patients between locations can be hazardous and technically difficult. Intrahospital movement requires as high a standard of care as interhospital movement.

If a retrieval team is involved in the transfer and while awaiting for their arrival, stabilisation and resuscitation of the patient, conducting further investigations and establishing appropriate monitoring, inserting lines and documentation should be done. A transfer must never be undertaken for an inadequately stabilised patient because of the high risk of complications during the journey<sup>(15)</sup>. In the US, consent is obtained prior to a transfer because of medico-legal considerations involved in the transfer process and the liability imposed on the transport team<sup>(7)</sup>.

The receiving physician is informed of patient's condition and needs, and if necessary, advised about stabilisation and initiation of therapy. Details of where to send the patient to, eg CT scan room or directly to the ICU is agreed upon. If there is no specialist transfer team, the referring doctor has to organise his own transfer team.

Having pre-packed transfer equipment and checklists minimise delays. Prior to departure, the receiving station is alerted. Determine if a traffic police escort is required. All medical notes, laboratory results, X-rays, details of treatment, monitoring charts and available blood products must be brought along.

Proper monitoring and a meticulous attitude, good communication and leaving no details to chance help ensure an uneventful transfer. Documentation of events during transport is important.

#### **ACKNOWLEDGEMENTS**

The author would like to thank Professor William Fitch, Professor of Anaesthesia, University of Glasgow for his suggestions and comments on reviewing the paper.

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