

## TRANSPORT OF CRITICALLY ILL PATIENTS

### Introduction

Inter-hospital and intra-hospital transport of critically ill patients places the patient at risk of adverse events and increased morbidity and mortality. Risk minimization can be achieved by being able to answer the following five questions properly:

1. Who needs to accompany the patient?
2. What equipment is needed, is the equipment checked and working?
3. Do you know enough about the patient to be able to predict specific problems along the way?
4. Have you got a transport plan?
5. Have you documented the process adequately?

Basic requirements are similar for inter-hospital and intra-hospital transport. Inter-hospital transport may, however, require more careful planning, a greater variety of drugs, greater attention to things like available battery life of equipment, availability of essential gases for life support systems, backup equipment, consideration of the transport vehicles drawbacks, knowledge of the effects of altitude etc.

### Indications for transfer

- When the referring department/hospital lacks appropriate staff, equipment, or diagnostic facilities for proper patient care.
- A medical judgment needs to be made that the risk of transport is outweighed by potential benefits to the patient at the destination.

### Risk Minimization

#### **1. Personnel**

At least two qualified medical staff should accompany each patient. Usually this should be a doctor and a nurse who both have some training and experience in airway management and management of acutely ill patients. Unstable patients require a higher level of expertise from the transport team. There must be a clear chain of responsibility throughout the transfer. A proper handover from referring doctor to retrieval doctor and then to the receiving facility doctor is essential.

#### **2. Equipment and Drugs**

Equipment and pharmacologic agents should be adequate in amount for each transport, taking into account, duration of transport and the patient's condition. Drugs to allow management of general emergencies (see below) should always be available. Additional drugs should be added depending on specific circumstances (eg: specific antiarrhythmic agents, antibiotic dosage due during transport). When choosing equipment, the following considerations are important: size, weight, battery life, durability, ability to fit to trolley railings, ability to function under conditions of vibration, ease of use in poor light, cramped spaces etc. Equipment should be adequately restrained, and continuously and conveniently

available to the operator. Equipment should be dedicated for transport use only, if possible. Availability of backup equipment may be desirable in certain circumstances.

The following equipment should generally be considered essential:

### Respiratory Support Equipment

- oxygen, masks
- self-inflating hand ventilating assembly with PEEP valve
- suction equipment of appropriate standard
- intubation set
- cricothyroidotomy set
- emergency pleural drainage equipment
- pulse oximeter
- end tidal CO<sub>2</sub> monitor for ventilated patients
- portable ventilator with disconnect alarm (PEEP ability desirable)

### Circulatory Support Equipment

- monitor/defibrillator/external pacer
- non-invasive blood pressure measuring device with appropriate sized cuffs
- vascular cannulae, peripheral and central
- IV fluids and pressure set (adequate for duration of transport)
- infusion pumps
- arterial cannulae and arterial monitoring device (if indicated)
- syringes and needles
- external pacing equipment (eg: post operative cardiac cases)

### Other Equipment

- nasogastric tube and bag
- urinary catheter and bag
- gloves
- restraints
- instruments, sutures, dressings, antiseptic lotions (if indicated)
- thermal insulation/and temperature monitor (if indicated)
- splints (eg: multitrauma case)
- spacers for inhaled drug administration eg: in asthmatics

### Drugs

Pharmacological agents that assist the management of the following emergencies should always be available:

- cardiac arrest
- intubation
- hypotension and hypertension
- agitation and pain
- cardiac dysrhythmia
- anaphylaxis

- bronchospasm
- hypoglycaemia and hyperglycaemia
- seizures

In specific circumstances it may be necessary to be able to treat the following during transport:

- raised ICP
- uterine atony
- adrenal dysfunction
- narcotic depression

### **3. Pre-departure check**

A checklist to ensure that nothing is forgotten is ideal:-

#### Patient

The more stable the patient is prior to transport the better. Of course part of the reason for transport may be that facilities at the destination are necessary to allow stabilization, in which case an unstable patient must be transported. In principle, stabilization of vital signs, provision of a secure airway (always check endotracheal tube position prior to departure) and secure IV access, securing of all catheters and provision of appropriate monitoring before departure is required. The transferring personnel should be familiar with the patient's history, condition and special requirements to allow appropriate planning and anticipation of problems unique to your patient. Consider appropriate physical restraints for the patient if indicated. Do not forget to take patient notes and images. If patient consent is required – do you have it?

Always reassess the patient immediately prior to leaving, with all transport equipment attached and functioning – following an A – airway, B – breathing, C – circulation, D – drugs, and E – equipment algorithm will ensure you don't miss anything.

#### Equipment

Some general principles are important:

- Choose equipment that you are familiar with and check every piece to make sure it works.
- Never place equipment on top the patient.
- Equipment often comes in different sizes - have an appropriate selection for your patient.
- Ensure adequate power (battery pack) backup and check that they are fully charged.
- Check that gas cylinders are full and function (estimate > 30 min more than needs).
- Check that you have enough spare IV fluids.
- Empty drainage bags if appropriate.

#### **4. The transport plan**

In addition to the general requirements noted above a number of conditions need to be met to ensure smooth progress of a transport event. A prospectively constructed plan should guide the process. Some essential questions to be answered when formulating the plan could be the following:

- What are the patient's special requirements and can they be safely met?
  - Need for PEEP, staff who can safely use a balloon pump during transport etc.
- Is the transport team fully aware of their responsibilities?
  - Nurse to check infusion pump function and O<sub>2</sub> cylinder gauge periodically etc.
- Is the receiving facility well informed and prepared to accept your patient?
  - Good and comprehensive communication channels, mobile phone etc.
- Have you carefully considered specific transport conditions?
  - Lighting, vehicle, road or weather conditions, distance involved etc.
- After arrival, have the receiving team adequately taken over management of the patient?
  - Adequate evidence of airway, circulatory, pharmacological support etc.

#### **5. Documentation**

A clear and concise record should briefly summarize the patient's clinical status before, during and after transport, including relevant medical conditions, environmental factors and therapy given. Documentation serves to remind the team to systematically check monitoring and patient status, helps to identify trends in the patient's condition earlier, and allows quality assurance activities. The medico-legal implications of documentation are obvious.

##### The conduct of transportation

The ideal way to imagine transport of a critically ill patient is to imagine it as a "mobile, but seamless continuation of the ICU environment". The most basic objectives of ICU care are to provide close monitoring of the physiological condition of patients and organ support to failing organs. The conduct of both monitoring and organ support will be dealt with by the other modules of this course, but some specific standards for monitoring during transport have been agreed by most experts.

Personal observation is essential during intensive patient care transport. This should be supplemented by appropriate monitoring devices:-

##### **Patient monitoring**

- The circulation must be monitored at frequent and clinically appropriate intervals by the detection of the arterial pulse and measurement of the arterial blood pressure.

- Equipment to monitor and continually display the electrocardiographic rhythm must be available for every critically ill patient during transport.
- Respiratory rate and function should be assessed at frequent and clinically appropriate intervals. The patient's oxygenation must be assessed at frequent and clinically appropriate intervals by observation, and pulse oximetry.
- When clinically indicated, equipment to measure other physiological variables, such as capnography should be in continuous use.

### **Oxygen Supply Failure**

- An automatically activated device to monitor oxygen supply pressure and to warn of low pressure should be fitted to the oxygen supply.

### **Breathing system disconnection or ventilator malfunction**

- When an automatic ventilator is in use, a device capable of warning promptly of a breathing system disconnection or ventilator failure should be in continuous operation.
- When an automatic ventilator is in use, a device capable of warning promptly of high pressure in the breathing system should be in continuous operation.

### **Further reading**

Warren J, Fromm RE Jr, Orr RA, Rotello LC, Horst HM, American College of Critical Care Medicine. Guidelines for the inter- and intrahospital transport of critically ill patients. Crit Care Med 2004; 32: 256-262.  
College/SCCM links.