Guidelines for Transport of the Critically Ill

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1. INTRODUCTION

1.1 Critically ill patients may have absent or small physiological reserves. Adverse physiological changes in these patients during transport are common and can be life-threatening. Ventilator-dependent and haemodynamically unstable patients are at particular risk.

1.2 Safe transport of the critically ill requires accurate assessment and stabilisation of the patient before transport. Careful planning and effective communication are required to move these patients between hospital facilities such as operating theatres, ICU, emergency department, imaging rooms, wards, and between different hospitals.

1.3 Safe transport requires the deployment of appropriately trained staff with essential equipment, and effective liaison between referring, transporting and receiving staff.

1.4 The transport itself must be justified. Whatever benefits of proposed interventions must outweigh the risks of moving the critically ill patient and those posed by the interventions themselves.

2. CATEGORIES OF TRANSPORT

Transport of critically ill patients is necessary in three sets of circumstances, namely, prehospital, interhospital, and intrahospital transport.

2.1 Prehospital transport refers to:

Transport of a critically ill patient from their location (home or site of accident) to hospital. Where prehospital transport is carried out by medical personnel, the same standards apply as for interhospital transport.

2.2 Interhospital transportation may be:

2.2.1 Emergency Interhospital Transport:

Where the referring hospital lacks appropriate staff, equipment, or diagnostic facilities, either immediately or when the patients' deteriorating condition requires more sophisticated facilities.

2.2.2 Semi-urgent Interhospital Transport:

For transport of critically ill patient, either to a higher level of care or for specialty service.

2.3 Intrahospital transport refers to :

Transport of critically ill patients from one area of hospital to another area within hospital for diagnostic or therapeutic reasons.

3. ADMINISTRATIVE GUIDELINES

Administrative guidelines should cover all aspects of the transport of the critically ill. Administrative guidelines may include matters such as insurance, budgeting and personnel. Staff training, safety and protection are the responsibility of the employing authority, which should carry appropriate insurance for all contingencies related to patient transport activities and should also provide personnel with personal protective equipment and instruction.

3.1 Initiation and response :

3.1.1 Medical transport services using road ambulances, fixed or rotary wing aircraft must be coordinated for prompt, rapid, efficient, and safe transport of critically ill patients on a 24-hour basis.

3.1.2 The method of initiation of patient transport should be simple, with clear guidelines and communication channels.

3.1.3 In all situations necessitating transport of the critically ill, rapid response of the transport system, together with minimal delays are paramount.

3.2 Coordination and Communication:

3.2.1 Coordination of transport services for the critically ill should preferably be centralised to ensure optimum utilization of resources. Designated individuals need to be available immediately for consultation and planning. Coordinating clinicians need to have an understanding of referring hospital capabilities and in-depth knowledge of receiving hospital capabilities. Coordinating clinicians need to have an intimate knowledge of the benefits and limitations of the transport frames at their disposal as well as the management capabilities of the retrieval team. Ideally coordinating clinicians should be

suitably trained in prehospital and retrieval medicine and have ongoing operational experience relevant to the type of transport undertaken.

3.2.2 Reliable communications must be available at all times between the transport team and the referring and receiving hospitals. At the time of first contact, clinical advice can be provided to referral staff and sought from senior staff of receiving specialty, allowing for appropriate planning and preparation for the transport.

3.3 Responsibility:

The chain of responsibility must be clear throughout the transfer. Responsibility for the patient care aspects of transport must be vested in an appropriately qualified medical practitioner. Formal handover from referring team to transporting team and from the latter to the receiving team is essential.

3.4 Documentation :

The clinical record should document patient's clinical status before, during and after transport, including relevant medical conditions, environmental factors and therapy given, adverse logistics events, and procedures undertaken.

3.5 Review and Quality Assurance:

3.5.1 Organisations involved in medical transportation should have an effective quality management system that can monitor and audit performance and make recommendations for appropriate improvements.

3.5.2 There should be a system for regular review of cases to assess the level of care provided, transport processes and logistics.

4. STAFFING

Personnel engaging in the transportation of critically ill patients should be selected and trained in the various aspects of patient transportation. Each team must be familiar with the equipment and be sufficiently experienced with securing airways, ventilation of the lungs, resuscitation, and other anticipated emergency procedures, such as vehicle evacuation by the authority operating the vehicle. Staff undertaking

patient transport must be aware of the capabilities and limitations of available equipment at the working transport environment and at the referral site prior to dispatch.

The transport team should consist at least of an appropriately qualified nurse, and an appropriately trained doctor with the specific skills and training required for such transport. Senior staff must also be regularly involved in these activities and be available for instruction and supervision of junior staff. An ability to communicate effectively, and to function as part of a team is essential.

4.1 Prehospital transportation :

Prehospital and retrieval staff should be provided with adequate personal protective equipment so that their safety is not compromised and that they are highly visible and easily identifiable at any prehospital scene. Medical officers and/or nurses who are deployed to provide prehospital treatment and transport must have received training that is in keeping with their expected pre-hospital role. They should be familiar with local pre-hospital ambulance and emergency service protocols, role responsibilities and equipment. Medical and nursing staff should also be familiar with the range of communication devices used.

4.2 Interhospital transportation :

Interhospital transport of critically ill patients must be performed by an appropriately qualified retrieval team including an experienced medical practitioner. This team must be familiar with their transport equipment particularly power and oxygen supply limitations. The retrieval team needs to have adequate clinical understanding of the patient's medical condition and potential transport complications (that is, altitude, temperature, movement, etc). The team must also be aware of the treatment options available to them prior to and during transport of the patient.

In the critically ill, it may be necessary to send expert medical assistance to the referring hospital.
Specifically trained personnel are required for transport of neonatal and infant, and patients requiring extracorporeal life support or an intra-aortic balloon pump.

4.3 Intrahospital transportation :

Appropriately trained medical and nursing +/- technical staff should accompany critically ill patients requiring intrahospital transport.

5. MODE OF TRANSPORT FOR PREHOSPITAL AND INTERHOSPITAL TRANSPORT

The mode of transport used will depend partly on clinical requirements and partly on vehicle availability and conditions.

5.1 Choice of transport vehicle will be influenced by :

5.1.1 nature of illness

5.1.2 possible clinical impact of the transport environment

5.1.3 urgency of intervention

5.1.4 location of patient

5.1.5 distances involved

5.1.6 number of retrieval personnel and volume of accompanying equipment

5.1.7 road transport time and road conditions

5.1.8 weather conditions for airborne transport

5.1.9 aircraft landing facilities

5.1.10 range and speed of vehicle

5.1.11 Availability of resources at the referring site.

5.1.12 Familiarity and training of retrieval staff on transport frame(s) available.

5.2 Transport vehicle requirements :

Vehicles should be appropriate to the task in terms of design and equipment. Regular inspection and servicing of vehicles and on-board equipment is required. Particular requirements relate to:

5.2.1 safety of both patient and staff

5.2.2 adequate space for patient access and to perform acute medical interventions

5.2.3 adequate power supplies and gases for life support systems

5.2.4 easy access for embarkation and disembarkation

5.2.5 adequate lighting and internal climate control

5.2.6 adequate suction

5.2.7 secured stretcher and equipment

5.2.8 acceptable noise and vibration levels and noise protection for passengers

5.2.9 adequate speed and response time

5.2.10 good communication systems, both internal and external

5.2.11 appropriate seating and restraints for staff

5.2.12 Both auditory and visual patient monitoring alarms

5.3 Medical fittings to aircraft, and bulky items carried need to have approval from the aviation authorities.

5.4 Air transport exposes patients and crew to particular risks including:

5.4.1 reduced oxygen partial pressure

5.4.2 the need for pressurization to sea level when clinically indicated

5.4.3 risk of rapid depressurization

5.4.4 expansion of air filled cavities; such as endotracheal tube cuff, middle ear, air-filled spaces under airtight dressings, etc

5.4.5 limb swelling beneath plaster casts

5.4.6 worsening of air embolism or decompression sickness

5.4.7 danger from agitated patients

5.4.8 limited space, lighting and facilities for interventions

5.4.9 noise

5.4.10 extremes of temperature

5.4.11 extremes of humidity

5.4.12 acceleration, deceleration and turbulence

5.4.13 vibration

5.4.14 electromagnetic interference between avionics and monitoring devices

5.4.15 danger from loose, mobile equipment

5.4.16 Motion induced illness

5.5 With all modes of transport, stabilisation of vital signs, provision of a secure airway and IV access, securing of all catheters and provisions of appropriate monitoring before departure is fundamental to safe transport.

6. EQUIPMENT

6.1 Equipment should be adequate in amount for each transport, taking into account duration of transport, patient's condition and level of therapeutic intervention required.

6.2 In choosing equipment, attention must be given to size, weight, battery life, oxygen consumption and durability, as well as to suitability for operation under conditions of transport. Trolley-linked devices must be able to enter lifts and pass through all doorways en route.

6.3 Equipment should be adequately restrained, and continuously available to the operator. Monitoring and infusion devices should be kept in areas visible to the accompanying staff. Patient stretchers should be adequately secured within the transport vehicle.

6.4 Electrical and gas supply fittings of all equipment must be compatible with those of the transport vehicle. All equipment to be used in aircraft must be assessed for compliance with regulatory requirements.

6.5 Supplies, including oxygen and pharmacological agents, should be in excess of that estimated for the maximum transport time.

6.6 Appropriate fully charged, spare battery packs for electrically driven devices must be available. All equipment needs to be properly maintained and regularly checked.

6.7 Specialised equipment is required for neonatal and paediatric transport, as well as patients requiring extracorporeal life support.

6.8 For intrahospital transport, all equipment must be able to function in specific intervention area (eg. a magnetic resonance imaging room) and facilities for remote patient monitoring should be available where required. Gas, suction, and electrical supplies at the destination must be present and compatible.

6.9 The following equipment should be considered :

6.9.1 Respiratory Support Equipment

6.9.1.1 airways

6.9.1.2 oxygen, masks, nebuliser

6.9.1.3 self-inflating hand ventilating assembly with PEEP valve

6.9.1.4 suction equipment of appropriate standard

6.9.1.5 portable ventilator with disconnect and high pressure alarms

6.9.1.6 intubation set with appropriate size blades and endotracheal tubes

6.9.1.7 emergency surgical airway set

6.9.1.8 difficult airway equipment

6.9.1.9 pleural drainage equipment

6.9.2 Circulatory Support Equipment

6.9.2.1 monitor/defibrillator/external pacer

6.9.2.2 pulse oximeter

6.9.2.3 non-invasive blood pressure measuring device with appropriate sized cuffs

6.9.2.4 vascular cannulae (peripheral and central)

6.9.2.5 IV fluids and pressure set

6.9.2.6 infusion pumps

6.9.2.7 arterial cannulae and arterial monitoring device

6.9.2.8 syringes and needles

6.9.2.9 pericardiocentesis and thoracotomy equipment

6.9.2.10 a sharps disposal container and a bag for biological refuse

6.9.3 Other Equipment

6.9.3.1 nasogastric tube and bag

6.9.3.2 urinary catheter and bag

6.9.3.3 instruments, sutures, dressings, antiseptic lotions, gloves

6.9.3.4 thermal insulation/and temperature monitor

6.9.3.5 splints and equipment for spinal and limb immobilization

6.9.3.6 neonatal/paediatric/obstetric transport equipment when applicable

6.9.3.7 dressings, bandages, slings, splints and tapes

6.9.3.8 cutting shears and portable torch

6.9.3.9 gloves and goggles for staff protection

6.9.3.10 alternate vascular access such as intraosseous devices for children

6.9.3.11 blood transfusion set

7. PHARMACOLOGICAL AGENTS

All drugs should be checked and clearly labelled prior to administration. The range of drugs available should include all drugs as necessary to manage patient's specific clinical condition and acute life-threatening medical emergencies:

7.1 cardiac arrest

7.2 hypotension

7.3 hypertension

7.4 cardiac dysrhythmia

7.5 pulmonary oedema

7.6 anaphylaxis

7.7 bronchospasm

7.8 hypoglycaemia

7.9 hyperglycaemia

7.10 raised ICP

7.11 uterine atony

7.12 adrenal dysfunction

7.13 narcotic depression

7.14 convulsions

7.15 agitation

7.16 pain

7.17 emesis

7.18 electrolyte abnormalities

7.19 provision of sedation and neuromuscular paralysis

8. MONITORING

Monitoring of certain fundamental variables should be carried out.

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

8.2 Patient monitoring

8.2.1 Circulation

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, and assessment of peripheral perfusion.

8.2.2 Respiration

Respiratory function should be assessed at frequent and clinically appropriate intervals.

8.2.3 Oxygenation

The patient's oxygenation must be assessed at frequent and clinically appropriate intervals by observation and pulse oximetry.

8.2.4 Level of consciousness by Glasgow Coma Scale and pupil reaction

8.2.5 Pain score

8.2.6 Patient comfort

8.2.6.1 even deeply-sedated patients should be provided with appropriate noise, eye and environmental protection.

8.2.6.2 Pressure care, including invasive devices, is essential for all patients who are unconscious, immobilised or have impaired movement, sensation and/or perfusion.

8.2.6.3 Ventilated patients in particular require continuous attention to eye care and effects of the ETT and other invasive devices

8.3 Equipment for Monitoring

8.3.1 Pulse Oximeter

A pulse oximeter must be used for every critically ill patient during transport with alarm turn on.

8.3.2 Capnometer

A capnometer (preferably with a waveform display) must be used to monitor all patients receiving mechanical ventilation. Waveform capnography should also be considered for sedated patients.

8.3.3 Alarms for Breathing System Disconnection or High Pressure and ventilator failure

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

8.3.4 Electrocardiograph

Equipment to monitor and continually display the electrocardiograph must be available for every critically ill patient during transport.

8.3.5 Physiological pressures

Equipment for the invasive or non-invasive recordings of blood pressure, and where clinically indicated, other physiological pressures should be available for all critically ill transported patients.

8.3.6 Other Equipment

When clinically indicated, equipment to measure other physiological variables, such as temperature and point of care blood analysis should be available.

8.3.7 Equipment Alarms

Equipment should incorporate audible and visual alarms.

9. PRE-DEPARTURE PROCEDURES

9.1 The transport team must be freed from other duties.

9.2 Before transfer, routes should be agreed and emergency strategies discussed.

9.3 The receiving person or staff at the destination must be notified, and the arrival time must be clearly understood.

9.4 All pieces of equipment must be checked, and notes and imaging films gathered. An example of a checklist is listed below. Individual responsibilities for checking equipment must be defined.

9.4.1 The monitors function properly and the alarm limits are set appropriately.

9.4.2 The manual resuscitator bag functions properly.

9.4.3 The ventilator (if used) functions properly; respiratory variables and alarms are set appropriately.

9.4.4 The suction device functions properly.

9.4.5 Oxygen (± air) cylinders are full.

9.4.6 A spare oxygen cylinder is available.

9.4.7 Airway and intubation equipment are all available and working.

9.4.8 Emergency drugs, analgesics, sedatives, and muscle relaxants (if appropriate) are all available.

9.4.9 Additional drugs are made available if indicated.

9.4.10 Spare IV fluids, inotropic solutions, or blood are available if needed.

9.4.11 Spare batteries are available for all battery-powered equipment.

9.4.12 Chest tube clamps (if an underwater chest drain is present) are available.

9.4.13 Patient notes, imaging films, and necessary forms (especially the informed consent form) are available.

9.5 Transportation of patients on circulatory supportive devices

9.5.1 For haemodynamically unstable patient requiring circulatory support, ensure that all the circulatory supportive devices have adequate battery power, in appropriate setting (including alarm limits if any) and are operating before and during transport.

9.5.2 There should be trained personnel who are able to provide the specialized care needed to stabilize, maintain and transport a critically ill patient on the circulatory supportive devices. The personnel should be trained in the set-up, operation and troubleshooting of the device.

10. PATIENT STATUS

10.1 Final preparation of the patient should be made before the actual move, with conscious anticipation of clinical needs. Examples include giving appropriate doses of muscle relaxants or sedatives, replacing near-empty inotropic and other IV solutions with fresh bags, and emptying drainage bags.

10.2 The patient must be reassessed before transport begins, especially after being placed on monitoring equipment and the transport ventilator (if used). Transport preparations must not overshadow or neglect the patient's fundamental care. An example of a brief check on the patient is listed below.

10.2.1 Airway is secured and patent.

10.2.2 Ventilation is adequate; respiratory variables are appropriate.

10.2.3 All equipment alarms are switched on.

10.2.4 Patient is haemodynamically stable.

10.2.5 Vital signs are displayed on transport monitors and are clearly visible to transport staff.

10.2.6 PEEP/CPAP (if set) and FIO2 levels are correct.

10.2.7 All drains (urinary, wound, or underwater seal) are functioning and secured.

10.2.8 Underwater seal drain is not clamped.

10.2.9 Venous access is adequate and patent.

10.2.10 IV drips and infusion pumps are functioning properly.

10.2.11 Patient is safely secured on trolley.

11. IN-TRANSIT PROCEDURES

11.1 A best route should be planned. Lifts should be secured or reserved beforehand.

11.2 Adequate communication facilities during transit and at the destination must be available.

11.3 The status of the patient must be checked at intervals, especially if the journey takes considerable time. Any changes in the patient's condition, unexpected event, or critical incident, must be acted upon immediately.

12. ARRIVAL PROCEDURES

12.1 On arrival at the destination, the receiving monitoring, ventilation gas, suction, and power facilities are checked if the patient is to be transferred from the transport facilities.

12.2 The patient must be assessed when the new monitors, ventilators (if used), gas and power supplies are established.

12.3 If another team assumes responsibility of care, a complete hand over is given to the team leader. The transport staff must remain with the patient until the receiving team is fully ready to take over care.

13. REFERENCE

Guidelines for Transport of Critically Ill Patients. ANZCA PS52 (2015)