

P. Ferdinande
on behalf of the Working Group
on Neurosurgical Intensive Care
of the European Society
of Intensive Care Medicine

Recommendations for intra-hospital transport of the severely head injured patient

Reprint requests to:

European Society of Intensive Care Medicine,
Avenue Joseph Wybran 40, 1070 Brussels, Belgium,
e-mail: esicm@pophost.eunet.be,
Tel.: + 32-2-5290350,
Fax: + 32-2-5270062

Members of the working group: Piek J (Germany; Chairman), Aerdt S (The Netherlands), Ansec-Letonja D (Slovenia), Asgeirsson B (Sweden), Bahar M (Turkey), Bellinzona G (Italy), Berré J (Belgium), Beuret P (France), Bochicchio M (Italy), Bruzzone P (Italy), Candiani G (Italy), De Deyne C (Belgium), Dive A (Belgium), Dobb G (Australia), Esen F (Turkey), Ferdinande P (Belgium), Floros J (Greece), Futo J (Hungary), Gemma M (Italy), Grande P (Sweden), Hemmer M (Luxemburg), Karlis P (Greece), Korfali G (Turkey), Moretti M (Italy), Rebelo A (Portugal), Ruetsch Y (Switzerland), Sonkajahru E (Finland), Spec-Marn A (Slovenia), Specht M (Germany), Telles de Freitas P (Portugal), Wöbker G (Germany)

Intra-hospital transport for critically ill neurosurgical patients

Intra-hospital transport or transport within the same hospital of the severe head injury patient may induce potentially harmful physiological instability. The decision to move such a patient must be based on the assessment of the potential benefits of the diagnostic test, the procedural intervention or the higher level of care (better technology and/or specialists) weighed against the potential hazards of transport. If the action is unlikely to alter the management or outcome of the patient positively, then the need to move the critically ill patient must be questioned. Alternative bedside tests and procedures must always be considered.

If transport is unavoidable, the risk to the patient can be reduced or minimised by the following: careful co-ordination and communication before transport, the use of properly qualified personnel and the selection of ap-

propriate equipment and monitoring for transportation. There should be no hiatus in the level of monitoring or maintenance of vital functions during transport.

The equipment available and the skills of the accompanying staff must be equal to the interventions required or anticipated for the patient (e.g. spine immobilisation, airway problems, etc.).

The following elements must be considered:

1. Pre-transport stabilisation
2. Pre-transport co-ordination and communication
3. Accompanying staff
4. Transport and monitoring equipment
5. Documentation

Guidelines on these five points will improve the quality of this potentially hazardous undertaking.

1. Pre-transport stabilisation

Stabilisation of the patient before transport is an obvious goal although overruling priorities (e.g. signs of impending brain herniation) may make this impossible. Stabilisation then becomes an ongoing activity during transport.

The ultimate end points of therapy are those set in the emergency room or intensive care unit (ICU). In general (unless otherwise stated):

- Pulse oximetry > 95 % oxygen saturation
- End tidal PCO₂ correlated to a PaCO₂ ± 35 mmHg (or 4.66 kPa)
- Arterial blood pressure (ABP)
 - ≥ 90 mmHg (Mean arterial blood pressure in adults)
 - ≥ 120 mmHg (Systolic arterial blood pressure in adults)
- Intracranial pressure (ICP)
 - ≤ 20 mmHg (in adults)
- Cerebral perfusion pressure (CPP)

≥ 70 mmHg (in adults)
Central body temperature
optimal 36 °C

2. Pre-transport co-ordination and communication

Communication: formal briefing from physician to physician, nurse to nurse and always when the management team changes during transport.

Pre-transport confirmation that the area where the patient will arrive is ready (operating theatre, imaging facility) to start the planned test and/or procedure immediately.

Notification of ancillary services (ambulances, technicians, medical sub-specialist, etc.) of the facilities needed for support and the time schedule.

Notification of the responsible ICU physician that the patient will be in another area of the hospital in the case of an acute event.

Notification of family and relatives of the need, timing, planning and risk of the transport. Informed consent when appropriate for planned procedures.

Documentation in the medical record of

1. Indications for transport
2. Patient's status before, during and after transport including Glasgow Coma Scale (GCS) and other neurological parameters.

A fail-safe communication system should be established between the transport team and the medical teams involved (ICU physician, neuroradiologist, trauma surgeon, neurosurgeon).

3. Accompanying staff

1. At least two people are needed and a third person may be useful (e. g. with the principal task of co-ordinating treatment and documentation of the critical patient during transport).
2. The emergency care/intensive care nurse assigned to the patient should accompany the patient during transport.
3. A severely head injured patient, patients with unstable physiology or at risk of acute deterioration should be accompanied by a physician during transport.

4. Transport and monitoring equipment to accompany the patient

The following items are considered to be either a minimum (m) or optional (o) requirement. The minimum requirements should be fulfilled during all patient trans-

ports, while the optional requirements should be readily available at the destination.

A. Transport equipment

A trolley or bed attachment to carry all equipment and drugs listed below is highly recommended for intra-hospital transfers. Battery-operated equipment should be thoroughly checked before transport. If the destination site is well equipped for emergency situations (suction, airway management, etc.) then the transport equipment can be reduced accordingly.

1. Airway management equipment and resuscitation bag adapted to the patient (size of endotracheal tubes, masks, etc.) (m)
Suction: Yankauer (large-bore tonsil tip). Suction catheters (to pass through endotracheal tube)
Bag valve device + connection to oxygen supply source
Mask
Oral airways
Endotracheal tube (ET) (+ 1 size smaller than expected)
Laryngoscope handle and blades (various sizes)
Syringe for cuff inflation
Stylet
Tape to secure ET
Stethoscope
Local anaesthetic/vasoconstrictor
Lubricant
Scissors
Gastric tube
2. Oxygen supply source with the projected needs of the patient + a 25 % excess reserve (m)
3. Intravenous fluids, drugs given by continuous infusion, blood and blood products
- 3a. The transport trolley should have a supply of items for short-term fluid therapy (o):
Peripheral i. v. catheters 14, 18, 20, 22 gauge
Central venous catheter
Infusion set, mini-drip administration set
Intravenous fluids
 - a. Plasma expander (e. g. colloid sol.) 500 ml
 - b. Sodium bicarbonate
 - c. NaCl 0.9 % 1000 ml
 - d. Mannitol 20 % 250 ml
 Disinfectant wipes
Blood pump bags
Tourniquet
- 3b. Drugs administered by continuous infusion are best given by use of the bedside battery-operated infusion pumps to avoid unnecessary interruption of life-supporting drugs (e. g. vasopressors) (m).

- 3c. Blood and blood products (o)
Blood and blood products (e. g. fresh frozen plasma, platelets, etc.) may be needed.
4. Drugs
- 4a. Standard transport drugs (m)
Atropine, glucose 30 %, corticosteroid, isoprenaline, dopamine, HCL, lidocaine, adrenaline, non-centrally acting antihypertensive drug, frusemide, noradrenaline, short-acting β -blocker
- 4b. Sedative, hypnotic drugs, analgesics and neuromuscular blockers (m)
Opioid, rocuronium bromide
Sedative
Sodium thiopental
Syringes (2.5, 10 ml), needles, ampoules of sterile water and NaCl 0.9 % (10, 20 ml).
5. Suction unit(s) (m)
Battery-operated for endotracheal suction and suction on life-sustaining devices, e. g., chest tube drainage (m)
6. Transport ventilator
Battery-operated and able to deliver a minute volume, airway pressure, FIO₂ and PEEP adapted to the patient's needs. Monitoring of airway pressures and expiratory minute volume. Alarms for high and low pressure and disconnection are all desirable. During the period when the patient is switched to the transport ventilator, a short period of observation (ICP, CPP, PECO₂, minute volume, blood gases, etc.) may help to detect acute unintended changes in ventilation (m).
7. Cardiac defibrillator and paddles (m)
8. A spinal board or comparable system to move the patient from the transportation stretcher to imaging or operating room tables without mobilisation of the spine (cervical collar, sandbags, etc.). Material to immobilise the patient (wrist restraints, adhesive tape, etc.). Ideally, the transportation stretcher should be designed to eliminate unnecessary movement of the patient. Changes in posture of the patient during transport should be avoided but very carefully performed if inevitable (m).

B. Monitoring equipment

ECG, pulse rate (+ monitoring electrodes) (m)
Two (preferably three) fluid pressures ABP, ICP and PAP (CPP display) (m)
Pulse oximetry (m)
Respiratory rate (m)
Capnography (desirable)
Central body temperature (o)
Non-invasive blood pressure monitor (m)
Visual display of 1 ECG lead, 2 pressure waves and digital display of systolic, diastolic, mean BP, ICP, heart and respiratory rate, saturation, temperature (m)
PECO₂ (desirable)
Nerve stimulator (o)

5. Documentation

Recordings of vital signs, intra-cranial pressure, GCS, neurological examination and focal neurological signs should be made at regular intervals during transport. Events and interventions occurring during transport should be reported.

These and other recordings, including haemodynamic and respiratory variables, should become part of the patient file.

Further reading

1. Jastremski MS, Hitchens M, Thompson M (1993) Guidelines for the transfer of critically ill patients. *Crit Care Med* 21: 931–937
2. Andrews PJD, Piper IR, Dearden NM, Miller JD (1990) Secondary insults during intrahospital transport of head-injured patients. *Lancet* 335: 327–330
3. Manji M, Bion JF (1995) Transporting critically ill patients. *Intensive Care Med* 21: 781–783
4. Waydhas C, Schneck G, Duswald KH (1995) Deterioration of respiratory function after intra-hospital transport of critically ill surgical patients. *Intensive Care Med* 21: 784–789
5. The Intensive Care Society (1997) Guidelines for transport of the critically ill adult. The Intensive Care Society, Tavistock House, Tavistock Square, London WC1H 9HR, UK