Guidelines for the Transport of Critically Ill Patients

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Transport of critically ill patients is an established practice in today's field of emergency medicine. Many potential problems may be avoided by optimization of the patient's condition before transport. Despite all efforts taken to minimize any complication arising during transport, we still have a long way to go and a Herculean task ahead of us.

Introduction

Safest place for the critically ill patient is in the intensive care unit (ICU), connected to a sophisticated ventilator with all infusion pumps running smoothly, monitoring equipment installed and with a nurse present to care for the patient. The patient is more or less in a controlled environment There may be situations when the patient has to leave these secure surroundings to be transported to the radiology department, operating room or some other hospital. This transport may create an increased risk for mishaps and adverse effects by disconnecting such critically ill patients from equipment, shifting them to another stretcher and reducing the person and equipment around.

This article provides the reader with the information about various adverse effects during transport and guidelines to perform safe transport of the patient; covering the personnel accompanying the patient, equipment for monitoring the patient and treating complications if any.

Adverse effects

Transport may affect a variety of organ systems, may be related to movement of the patient e.g. dislocation of installations, drips etc. or caused by equipment malfunction. Further, a reduced availability of personnel, equipment and monitoring away from ICU may be detrimental The first indication that transport with in hospital is a dangerous undertaking was provided in early 1970's when arrhythmias were encountered in upto 84% of transport of patients with cardiac disease, which required emergency therapy in 44% of cases (1).

Hypotension and arrhythmias occur predominantly in mechanically ventilated patients (2, 3). Events being closely related to periods of hypoventilation or hyperventilation with changes of pCO_2 of up to 27 mm Hg. Respiratory complications include changes in respiratory rate, fall in PaO₂ (4). In patients with head injury, adverse effects include hypotension, hypoxia and increased intracranial pressure.

Equipment related complications include ECG lead disconnection, monitor power failure, disconnection of intravenous or intra arterial lines or from the ventilator itself (4). Failure of suction apparatus to work during transport or accidental extubation would lead to disastrous consequences. To prevent all such complications, various guidelines for transport of critically ill patients were reported by representatives from several major critical care societies. These introduce the minimum requirements, which should be available during the transport of any patient in serious condition.

General Principles

Definition:- Critically ill patients are those that by dysfunction or failure of one or more organs/system depend on survival from advanced instruments of monitoring and therapy (5).

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Following steps are taken

1. Decision:- The decision of transporting a patient in serious condition is a medical action. Therefore, the responsibility is ascribed to the doctor who is attending the patient but also from the chief of the team and the service direction.

2. Planning:- The planning of the action is affected by the medical and nurse team of the service or unit and considers the following problems:-

- (i) Choice and contact with the receptor service, evaluating the distance and time delay.
- (ii) Choice of mode of transport- air or road. If the distance is greater than 150 km, air transport is preferred.
- (iii) Selection of accurate monitoring methods and devices.
- (iv) Prediction of possible complications.
- (v) Selection of general and specific therapy instruments.
- (vi) Choice of transport team (according to the availability and the characteristics of the patient).

3. Implementing:- The implementing of the transport is incharge of the selected transport team and its technical and legal responsibility finishes only when patient is delivered to medical team of destinations service or on arrival to original service (when transport is done for fulfilling of any diagnostic/therapeutic procedure).

Intra-hospital transport of critically ill patient

The transport is in the hospital of the patient should follow these rules:-

1. Coordination before the transport

- (a) Previous information that the area where the patient is meant to be moved is ready to receive service him/her and to make the exam or planned therapy.
- (b) Doctor in charge should accompany the patient and communication between doctor to doctor and nurse to nurse should be established, regarding the medical situation of the patient and the therapy before and after removal.
- (c) Write in the medical record the events occurred during the transport and the evaluation of the condition of the patient.

2. Professionals with the Patient:- Two professionals (doctors/nurses) should accompany the patient in serious condition at least

- (a) One of the professionals should be the nurse in charge of the patient, with experience in CPR or specially trained in transport of patients in serious conditions.
- (b) In accordance with the serious condition and instability of the patient, second professional can be a doctor or nurse.
- (c) A doctor should attend the patients who present physiological instability and eventually will need an urgent action.

3. Equipment to support the patient

- (a) Transport Monitor
- (b) Blood Pressure reader
- (c) Endotracheal intubation kit and manual resuscitator
- (d) Oxygen source with a predictable capacity for the whole period of transport, with additional reserve for 30 minutes.
- (e) Portable ventilator, with availability to offer volume/minute, pressure FiO₂ of 100% and PEEP with disconnection alarm and high airway pressure alarm.
- (f) Suction apparatus with suction catheters.
- (g) Drugs for resuscitation, namely adrenaline, lignocaine, atropine and sodium-bicarbonate.
- (h) Intravenous fluids and infusion of drugs ruled by syringes or infusing pumps with battery.
- (i) Additional medications to be administered according to medical prescription.

4. Monitoring During the Transport :-The levels of monitoring have been divided according to following (6):-

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Level 1	-	Compulsory

- Level 2 Highly recommended
- Level 3 Ideal
- Continuous Monitoring with Periodical record * ECG (Level 1)
 - * Pulse Oximetry (Level 1)
- Intermittent Monitoring and record
 - * Blood Pressure (Level 1)
 - * Heart rate (Level 1)

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* Respiratory rates (Level 1 in Paediatrics and Level 2 in other patients)

• In Selected Patients

- * Capnography (Level 2)
- * Continuous measure of blood pressure (Level 3)
- * Measure of the pulmonary artery pressure (Level 3)
- * Measure of Intracranial Pressure (Level 3)
- * Measure of Central Venous Pressure (Level 3)
- * Measure of airway pressure in mechanically ventilated patients (Level 1)

Inter hospital transport of critically ill patients Introduction

- * The main reason for the transport of a patient in a serious condition from a hospital to another one is the lack of diagnostic and therapy resources (human & technical) at the hospital of origin.
- * The decision of transporting a patient with these characteristics is taken after evaluation of benefits and risks subject to transport.
- * The risk of transport takes two parts.

Medical risk:- The medical situation of the patient; vibration effects, acceleration-deceleration and changes of temperature.

Travel risk:- Vibration and collision risks.

* In order to minimize the risks of transport it is important to stabilize the patient at the hospital of origin and do required diagnosis and therapies to prepare a safe trip (venous access, intubation etc.)

Before the initiation of transport, the patient or his/her legal representative should be informed of the fact and an explanation of the situation, reason for transport, name of referral hospital should be given and when necessary his/her agreement.

1. Coordination before Transport

- (a) Once the decision of transport is taken, it should be done as soon as possible.
- (b) The doctor responsible should take care that all the required resources for the treatment are available at the hospital of transfer. The service expected to accept the patient should be fully informed of the medical situation and the predictable therapy procedures.

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- (c) The initial contact is done before the transport and it should be individualized; names and contacts of the participants in the process of transfer should be recorded.
- (d) Medical and nursing records and the complementary diagnostic exams will be sent with the patient.

2. Choice of modes of transport should consider

- (a) Medical situations of patient (emergent, urgent/ elective)
- (b) Distance/timing of transport
- (c) Necessary medical procedures during transport
- (d) Staff availability and resources
- (e) Weather forecast
- (f) In case of air transport it is also important to be aware of possible physiological changes regarding the altitude and its influence on clinical features.

3. Professionals to escort the patient

- (a) Crew of the ambulance
- (b) Doctor with the nurse both with experience in CPR and equipment

4. Equipment to serve the patient (7, 8)

- (a) Manual resuscitator and appropriate masks
- (b) Mayotubes, laryngoscopes endotracheal tubes and guide strings
- (c) Oxygen source with appropriate capacity required $O_2 = [(20+Vmin)xFiO_2xTransport timing]+50\%.$
- (d) Aspirator and Probes
- (e) Thoracic drains, introductions kit and accessories
- (f) Transport monitor and defibrillator
- (g) Automatic blood pressure reader and appropriate armbands
- (h) Material for puncture and maintenance of various lines (catheters, syringes and infusion systems)
- (i) I/V fluids (crystalloids and colloids)
- (j) Drugs for advanced life support.
- (k) Transport ventilator with volume/minute, pressure, PEEP and FiO_2 with reliable regulation systems, capacity of monitoring of airway pressure, apnoea; high pressure and disconnections alarm during the paediatric transport the FiO_2 and volume pressure should be strictly controlled.

- (l) Communication Equipment
- (m) Drugs available to a transport team -
- Adenosine
- Alfentanil
- Amiodarone
- Sodium Bicarbonate
- Cefotaxime
- Diazepam
- Isosorbide Dinitrate
- Dopamine
- Phenobarbital
- Furosemide
- Heparin
- Hydrate Chloral
- Isoprenaline
- Methylprednisolone
- Morphine
- Noradrenaline
- Propofol
- Succinylcholine
- Magnesium Sulphate
- Vecuronium Bromide
- Labetalol hydrochloride

- (a) Continuous monitoring with periodical record
 - ECG (Level 1)
 - Pulse Oximetry (Level 1)
- (b) Intermittent monitoring and record
 - Non invasive blood pressure (Level 1)
 - Heart Rate (Level 1)
 - Respiratory Rate (Level 1 in Paediatrics & 2 with other patients)

- Intermittent measure of central venous pressure
- Airway pressure (Paw) in patients who are intubated and mechanically ventilated.

On the other hand, a change in patient management results from about half of the procedures that necessitate

- Adrenaline • Aminophylline • Atropine
- Captopril
- Dexamethasone
- Digoxin
- Dobutamine
- Etomidate
- Flumazenil
- Calcium Gluconate
- Hydralazine
- Actrapid Insulin
- Mannitol
- Midazolam
- Naloxone
- Paracetamol
- Salbutamol
- Nifedipine
- Thiopental Sodium
- Verapamil.
- 2% Lignocaine (+gel and spray)
- Nitroglycerine or Glyceryl Trinitrate

5. Monitoring

(c) In Selected Patients

- Capnography (Level 2)
- Continuous measure of Blood pressure
- Pulmonary artery pressure
- Intracranial Pressure

Conclusion

Adverse effects during and after transport are high.

transport, indicating good efficiency. Although a few patient related risk factors can be identified rate of equipment related adverse events is also high. Thus, a particular attention is to be focussed on the personnel, equipment and monitoring in use. In some cases, hazards of transporting a patient could be prevented by performing diagnostic / therapeutic procedures with in the ICU itself. Such interventions may comprise the following; use of chest ultra sound in detecting intrathoracic pathologies; use of new mobile CT scanners, facilities for dialysis with in the ICU placement of percutaneous endoscopic gastrostomy and IVC filters etc.

Potential weakness remains the mode of ventilation and type of ventilator to be used during transport as well as the extent of respiratory monitoring. So, either portable ventilators equipped with volume meter or specifically constructed carts including standard ICU ventilators can be used. As mentioned above, it is advisable to perform as far as possible all the diagnostic and therapeutic procedures in the ICU itself to decrease the rate of mishaps.

Needless to state, in case of lacunae in either trained staff or equipment required to transport it is better to manage a critically ill patient at the hospital of origin.

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