Section: 4

SUMMARY

Objectives
To develop guidelines for the intrahospital and interhospital (secondary) transport of the critically ill adult patients suitable for the Indian circumstances, to help standardize the equipment, the personnel and monitoring during these periods.

Basis of guidelines
The Medline was searched for recent literature using terms: transport of critically ill, intrahospital transport, interhospital transport, transport and critically ill. Related articles were looked for after identifying main articles in English language, attempt was made to get full text articles. There is no Indian data published on the subject. There are no studies in many areas related to transport of critically ill patients, therefore personal experience of committee members and expert opinion form the basis of recommendations in such circumstances.

Method
Committee members were allotted different areas related to transport of critically ill. Drafts were discussed using electronic communication amongst committee members. During a formal meeting guidelines were formulated.

Guidelines development
Guidelines are developed for various types of transport, and presented as such
(1) Intrahospital transport
(2) Interhospital (secondary) transport.
(3) Air Transport in Indian Conditions
(4) Medico legal aspects of transporting critically ill patients.
The appendices detail
(1) prehospital (primary) transport
(2) ambulance Specifications
(3)Equipment, Drugs and monitoring required during transport,
(4) training of personnel,
(5) Format for transport.

Conclusions
Indian healthcare professionals and healthcare organizations need to develop and standardize a plan suitable for their particular circumstances and train individuals and obtain equipment according to budget availability as standardized health care similar to developed countries is lacking. These guidelines will help in development of these local plans and help in safe transport of the patients.

^Top

Introduction

Transport of critically ill patient is a hazardous undertaking leading to adverse physiological effects. Studies are lacking in most areas related to transport. Some data is available on the benefits of transport in terms of change in treatment because of transport, complications during transport, use of portable imaging in ICU instead of transporting the patient, effect of trained personnel accompanying patients, etc. Most professional intensive care organizations in the world such as SCCM, ANZICS, and others have developed their own guidelines.[1-6] All these assume availability of minimum standard of monitoring and equipment due to either National Health Services or equivalent through out the country. The Indian scenario is completely different. In India, ICUs range from state of the art ICUs; which can compete with the best in the world; to basic ICUs; which can give initial resuscitative care only; before transporting the patient for further care. It is a difficult task to develop guidelines for such diverse requirements. Since not much Indian data is available and due to scarcity of evidence in many areas, many of our recommendations are based on existing guidelines of other professional bodies, expert opinion and consensus arrived at during the meeting of the committee members. Prehospital transport forms a separate domain altogether and comes mainly under the purview of EMS. Only a basic outline of prehospital transport is therefore presented in the appendix for the sake of completion.

BASIS OF GUIDELINES

In this section of guidelines the available literature on intrahospital and interhospital transport is summarized.
The transport of critically ill patients always involves some degree of risk to the patient and sometimes to the accompanying personnel. Therefore, the decision to transport must be based on an assessment of the potential benefits of transport weighed against the potential risks. The basic reason for moving a critically ill patient is the need for additional care, either technology and/or specialists, not available at the patient's current location. Provision of the needed modality may require movement of the patient within the hospital to a diagnostic testing suite, operating room or specialized Intensive Care Unit (ICU) or to another hospital. Rapid transport of patients to specialized centers is widely used in the management of myocardial infarction, trauma, and more recently, acute stroke; with proven benefit.

Several studies have shown that transporting critically ill patient can lead to change in therapy in a large number of patients. When transport was carried out for diagnostic procedures in trauma, vascular and abdominal surgery patients, it led to change in management in 40% of patients. CT scan of the abdomen and angiography had the highest diagnostic efficacy[7]. Similarly studies of abdominal and thoracic CT scans have shown that these examinations can alter management in 26 – 70% of surgical and non-surgical critically ill patients.[8-10]

Availability of an option for bedside imaging will obviously change physician preference. A recent survey of physicians on use of portable CT scan in ICU patients found that 100% physicians preferred to do a bedside CT in unstable

patients. Patients' severity of illness was most common indication for ordering a portable CT scan[11]. Patients on extracorporeal lung assist (ECLA; 93%), patients with cardiovascular instability (70%), those with respiratory instability (57%), and those with neurologic instability (40%) were deemed too ill to transport. However if portable CT was unavailable, most physicians (80%) were in favour of transporting a patient rather than delaying the investigation. Portable CT scan revealed unexpected findings such as intracerebral hemorrhage, abdominal fluid collection, pneumothorax despite existing chest tubes, empyema, and posterior (dependent) lung atelectasis leading to emergent operative procedures, CTguided chest tube placement, and institution of prone positioning therapy. A portable CT scan is likely to be a distant dream for most Indian ICUs; however optimal use of available imaging modalities such as portable ultrasound can help avoid need for transport provided the physician does not feel it is going to compromise quality of imaging.

Procedures such as tracheostomy, percutaneous drainage, should be performed in the ICU, if necessary under portable ultrasound guidance or C-arm guidance, provided asepsis is maintained and this will help avoiding transport of the patient. Percutaneous tracheostomy for example is a well established procedure and can be done safely in ICU by properly trained intensivist. Other interventions which can be performed in the ICU are use of chest ultrasound in detecting intrathoracic pathologies; the placement of percutaneous endoscopic gastrostomy
and of inferior vena cava filters; fiberoptic intraparenchymal pressure monitoring instead of operative ventriculostomy; scheduled reoperations for peritonitis with open abdomen in the ICU[12].
Surprisingly Szem et al[13] reported no difference between complication rates of surgical ICU patients transported within a hospital and complication rates of patients not transported. However, there was an increase in mortality in the patients who were transported, when Acute Physiology and Chronic Health Evaluation II and III- matched controls were compared. It was proposed that this difference in mortality may have been because patients requiring transport out of the surgical ICU were more critically ill. However many adverse effects have been otherwise reported in the literature. Taylor et al[14] reported extremely high incidence (84%) of arrhythmias requiring emergent treatment as early as 1970. Cardiovascular adverse effects ranging from hypotension, hypertension, arrhythmias, and cardiac arrest have been reported in 0 to 46% of diverse population of critically ill patients transported for diagnostic purposes to the radiology department 13, [15-18]. Andrews & colleagues also reported a rise in ICP in 23% of their trauma patients transported to radiology[19].

Wadhyas and colleagues[22] evaluated the impact of 49 intrahospital transports in 21 mechanically ventilated critically ill patients (median Apache II score 21 range 7 -35) on respiratory function. They aimed to keep the same PO_2 by adjusting if necessary the FIO2 (n=20), PEEP (n=2) or both (n=10). A significant decrease in PaO_2/FiO_2 ratio from 267 before to 220 one hour after transport was observed during 41 out of 49 transports. In 10 patients this deterioration persisted for more than 24 hours, in others the PaO_2/FiO_2 ratio returned to baseline within 6 – 24 hours. Ventilation with PEEP was the main difference in the patients whose

respiratory function deteriorated significantly and those who remained stable. Gervais et al[22] compared blood gas variables during transport of 30 ventilator-dependent patients who were ventilated using either a manually operated ventilation bag with or without a volume meter at the exhalation valve of the bag, or a time-cycled, volume-constant, portable ventilator. They found that the oxygenation was well maintained in both the groups, but patients with manual ventilation alone or the transport ventilator were significantly hyperventilated leading to respiratory alkalosis, when the minute volume was not monitored. Braman & colleagues compared manually ventilated patients with patients ventilated using a portable ventilator during intrahospital transport. Significant deterioration in haemodynamics was seen in 75% of the manually ventilated and 44% of the mechanically ventilated patients. Similar ratios were noted in blood gas abnormalities: 70% of the manually ventilated group and 38% of the mechanically ventilated group experienced a change from baseline in $PaCO_2$ greater than 10 mmHg or a change in pH of >0.05 units. The authors concluded that prolonged manual ventilation is difficult to maintain accurately and that the aid of a spirometer or end-tidal CO_2 monitor might help to ensure stable minute ventilation. Braman and colleagues[24] also reported significant respiratory alkalosis due to manual hyperventilation of the patients while oxygenation remained unaffected.

Equipment and monitoring related complications have been reported[25, 26] to range from 10-34% during transport. These include disconnection of monitoring leads, power failure due to incomplete charging, disconnecions of indwelling catheters or vasoactive drug infusion, loss of nasogastric or chest tube, disconnection from the ventilator were among the most frequent problems. Most mishaps were noted at the destination site either before or during the procedure, but not during the actual transport during these studies. This can put patients to considerable risk of mishaps and can be avoided by appropriate attachment of monitors and fixation of indwelling catheters while preparing the patient for transport. Mishaps related to equipment disconnection and malfunction can be minimised with use of trained personnel or special transport team, specially designed vehicle and setting appropriate protocols for transfer of such patients out of ICU whereas physiological deterioration is more likely due to continuing pathological process. However if the transport is judged to be mandatory, an attempt should be made to optimize the patient and continue the management during transport. Guidelines exist concerning timing of transfer for certain groups of patients—for example, those with head injury or myocardial infarction. For patients with multiple organ failure the balance of risk and benefit needs to be carefully discussed by senior staff. The decision on whether and how to send or retrieve a patient will depend on the urgency of transfer, the availability and experience of staff, equipment, and any delay in mobilizing a retrieval team.

Optimal resuscitation and patient preparation can reduce the complications associated with intrahospital transport. Andrews et al[19] compared 35 head injured patients transported from ICU with 15 patients transported from accident and emergency department. Physiological variables were monitored 4 hours before, during and 4 hours after transport. Pretransfer insults were predictive of further insults during and after transport. They demonstrated significant

correlation between high injury severity score and number of complications during transport. Also a greater proportion of patients transported from the emergency department had secondary insults during intrahospital transport. This study underlines the fact that adequate resuscitation before transport can help minimize complications during transport in patients with multiple injuries. Obviously, all critically ill patients will benefit from adequate preparation including resuscitation carried out before transport.

Smith et al[26] reported that Therapeutic intervention scoring system (TISS) class IV transports had the highest rate of mishaps (35%). They found no relationship of occurrence of mishaps to severity of illness (Acute Physiology and Chronic Health Evaluation, APACHE II), number of lines, monitoring and support modalities, and time out of the ICU. As noted earlier, higher injury severity score predisposes the patient to complications during transport. Mechanically ventilated patients requiring PEEP and FiO_2 > 0.5 form another subgroup of high risk patients[25,28, 29]. Haemodynamically unstable patients requiring continuous infusion of dobutamine, or a continuous infusion of norepinephrine are also at high risk of complications during transport[13].

Ideally the patient should be accompanied by a physician along with the nurse looking after the patient26. Stearly[17] reported complication rates during 237 instances of intrahospital transport of critically ill patients who were accompanied by specially trained ICU nursing staff. The patients moved by the specially trained transport team has a 15.5% overall complication rate, with 10.2% minor, 2.5% moderate (compensated for with medications), and 2.8% severe complications that did not respond to intervention. No medications or therapies were delayed, and only 2 patients (0.8%) had decompensation that required the examinations to be aborted. This was significantly better than the reported national complication rates for intrahospital transportation of patients. He concluded that use of a specially trained ICU transport team can substantially reduce the rate of adverse outcomes generated by the transportation of critically ill patients[17]. Bellingan G et al30 compared effect of a specialist retrieval team with current United Kingdom practices for the transport of critically ill patients and they did observe significant reductions in surrogate physiologic markers like metabolic acidosis and severe hypotension and a non-significant reduction in mortality within 12 hours of arrival at the receiving facility.

With adequate pretransfer preparation, it is possible to transport even extremely sick ICU patients[31]. Gebremichael M et al[32] reported the outcome of 39 patients with respiratory failure who underwent road transfer using a specially designed mobile intensive care unit, equipped and staffed to nearly recreate the intensive care environment. 72% of the patients had an arterial line, 67% pulmonary artery catheter, 56% of the patients needed vasoactive drugs, The mean positive end-expiratory pressure requirement of 15.9, a mean FIO_2 requirement of 0.93, and a mean PaO_2/FiO_2 ratio of 59.8. They had only one death during transport. Uusaro and colleagues[33] transported 66 unstable patients with ARDS & circulatory failure, over long-distance in customized ambulances. 89% of the patients had inotropes infusion and 21% were transferred in prone position due to life threatening hypoxia.There were no major complications during the

transfer. This study demonstrated that long-distance interhospital ground transfers of even the most critically ill patients are safe, provided you have dedicated transport team, proper patient stabilization before transport, and a transport vehicle with intensive care facilities. Another group[34] also reported successful transport of 8 severely hypoxemic ARDS patients requiring ECMO support without major complications. A retrospective case control Australian study[35] carried out over 3 years found that critically ill patients undergoing acute interhospital transfer experience a delay in admission to ICU, and a longer length of stay in ICU and hospital when compared to their ICU counterparts who were not moved. However, there was no significant difference in hospital mortality between the two groups, and there were no deaths during transfer.

Adverse physiological effects are not uncommon during transport of critically ill patients. Transport for diagnostic procedures seems to yield useful information leading to change in therapy in a significant number of patients, provided the patients are selected carefully bearing in mind the high risk patients. Proper pretransfer preparation, use of appropriate equipment monitoring and experienced personnel make transport of the extremely sick patients possible. The mishaps related to equipment related problems can be minimized by strict adherence to guidelines. It may be possible to avoid transport in a select group of patients by use of alternative bedside diagnostic and therapeutic modalities.

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^Top

INTRAHOSPITAL TRANSPORT

Intrahospital transport involves following areas of concern: protocol development and written procedures, the decision for transport, identifying high risk patients, preparation of the patient, pretransport coordination & communication, accompanying personnel, equipment, drugs, and monitoring, care during transport, and care at destination.

1. Protocol development & Written Procedures

- In Indian hospitals, the infrastructure will vary from place to place, therefore each ICU needs to develop its own solutions to substitute for lack of sophisticated equipment, develop a protocol and implement it. The existing guidelines of the professional organizations around the world can be suitably modified to local use.
- These protocols should be widely known to all departments of the hospital.
- Proper documentation should occur at each stage during transport. This will help in audit, quality assessment and then modification for improvement in the local protocols.

2. The Decision

- Diagnostic or interventional procedure (such as ultrasound instead of CT scan) should be undertaken in the ICU, if this does not compromise the quality of imaging; to avoid transport.
- Similarly minor surgical procedures (such as tracheostomy) should be undertaken in the ICU, provided asepsis is maintained and quality of care is not compromised.
- The intensivist and primary physician (often separate from the intensivist in the Indian setting) will take the decision to transport the patient. The involvement of the primary physician should be documented in all such instances.
- Documentation in the medical record includes the indications for transport and patient status throughout the time away from the unit of origin.
- The risk of transporting the patient must be outweighed by the benefit that may accrue from the transport. The aim or purpose and the justification to transport should be noted in the case records.
- The patient's family should be informed of the risks involved and possible benefits should be explained to them preferably in presence of the primary physician and the conference documented.
- Patient's or the responsible person's (surrogate decision maker) consent should be taken in the standard format. Similarly the primary physician's concurrence may be documented in the same form. (see Appendix V - Pretransport Checklist for intrahospital transport)
- Transport of the patient should not be undertaken in the following circumstances:

    - Inability to provide adequate oxygenation and ventilation during transport either by manual ventilation, portable ventilator, or standard intensive care unit ventilator,
    - Inability to maintain acceptable hemodynamic performance during transport
    - Inability to adequately monitor patient cardiopulmonary status during transport
    - Inability to maintain airway control during transport.
    - Transport should not be undertaken unless all the necessary members of the transport team are present.

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3. Identification of high risk patients

- Identification of high risk patients before transport helps in formulation of plan for transport.
- Patients in following categories are at particularly high risk of physiological deterioration during or after transport.

- The mechanically ventilated patients, particularly those with requirement of positive end expiratory pressure and FIO2 > 0.5.
- Patients with high Therapeutic Injury Severity Score
- Head injured patients
- Haemodynamically unstable patients requiring continuous infusion of dobutamine, or a continuous infusion of norepinephrine or other potent vasoactive agents.

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4. Preparing the patient for transport

- Unless the need to transport the patient is absolutely urgent (such as transport to the OT to stop bleeding) all attempts should be made to optimize haemodynamics and ventilatory parameters.
- Patient should be optimally fluid resuscitated, and on minimal vasoactive drugs as permitted within the clinical context.
- Confirm that the airway is patent, if intubated or tracheostomised, confirm proper fixation of the ETT or TT.
- An attempt should be made to modify the ventilatory requirements of the patient such that they can be met during transport, if this is not possible transport must not be undertaken till such condition obtains. The management of transport of critically ill patient is discussed separately under 'Transporting Mechanically Ventilated patients.'
- Attempts should be made to leave only essential infusions running.
- The patients physiological variables and drug and ventilatory requirements before transport must be documented.
- Appendix V contains a standard format for pretransport documentation. This may be modified to meet local needs of the units undertaking transport.
- Patient should be adequately sedated as transport is a period of great stress. If required additional doses of sedatives, narcotics should be given just before embarking on transport. These drugs should also be available for use during transport if required.
- When using manual ventilation use of muscle relaxants often makes it easier to transport a ventilated patient.
- It is possible to transport patient with high ventilatory requirements, without administration of muscle relaxant on spontaneous (with assist) breathing, if sophisticated transport ventilator which have trigger function, is available.
- In case of non-availability of such ventilators, a PEEP valve (to deliver the same level of PEEP as in ICU) and a Self-inflating bag with reservoir (to deliver near 100% O2) should be used.
- It is imperative to assess whether patient maintains physiological variables after being placed on transport ventilator and monitoring equipment. It is often best to observe the patient in the ICU on the transport setting to see if they tolerate the change from sophisticated ICU

ventilators to manual or transport ventilators.

- Moving patients to and from examination tables, onto stretchers, and over bumps while entering elevators may cause fractures to become improperly immobilized. The situation becomes even more crucial if the patient has suspected spinal column involvement. Proper adjuncts such as splints and backboards should be in place before transport.
- Special pharmacological requirements, if any, should be anticipated and these drugs should be available apart from the standard drugs required during transport.
- Drainage bags should be emptied. Intercostal and other drains should be checked and clamped if required.
- Venous access should be adequate for the patient's clinical condition (a bleeding patient will need large bore access) and should be checked for patency.
- The vascular access cannulae should be fixed securely.
- Fresh infusion bags and vasoactive and other drugs should be diluted and kept ready for use during transport.
- The patient should be safely secured to the transport trolley.
- The patients' medical records, previous films if any and necessary forms (especially the informed consent form particularly if the transport is for intervention) are available.
- If the patient is being transported to the operating rooms, arrangement for blood and blood components should be done by the ICU personnel. Informed consent for operative procedures should accompany the patient.

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5. Pretransport coordination and communication

- In most Indian ICUs, for diagnostic and /or interventional procedures in Radiology, endoscopy, doppler studies, patients will be transported by the ICU team and continuity of care will be maintained without there being a transfer of care.
- Before setting off from the ICU, the department where patient is going to be transported should be informed, to avoid a wait at the receiving location.
- The receiving location must be ready to perform the diagnostic and / or intervention procedure immediately on the arrival of the patient.

- Many ICUs in India are still open units and the primary physician may want to participate in the transport.
- If the primary physician does not wish to accompany the patient during transport, he should be informed that the patient is being moved out of the ICU.
- When the patient is being moved for an operative procedure to the operating room, an alternate team will assume management responsibility for the patient after arrival, and a proper communication regarding the patients' condition and the treatment plan should be ensured by

physician-to-physician and/or nurse-to-nurse communication.

- This communication occurs each time patient care responsibility is transferred from and to the ICUs at the end of transport.
- That this communication has occurred and the patients' condition at the time of transfer of care should be documented in the patient medical record. The standardized format (Appendix V) should allow this documentation.
- The personnel undertaking transport should be freed from all other duties.
- Other members of the healthcare team (e.g., respiratory therapy, hospital security) then are notified as to the timing of the transport and the equipment support that will be needed.
- A check must be conducted of the receiving location as to availability of oxygen outlets, adequate power supply (power points – etc) particularly if the procedure or interventions are going to take a long time.
- In new hospitals during construction, the likely requirements for transported ICU patients should be taken in account.

6. Accompanying Personnel

- The patient should be ideally accompanied by a physician, along with the nurse looking after the patient.
- This may, however, lead to serious manpower depletion issues in most Indian ICUs with current staffing patterns. In that case, a physician or a trained person (may not be an ICU person) and an ICU technician can accompany the patient.
- If the patient is unstable, then the nurse, apart from the ICU physician, should also accompany the patient.
- He / She should be competent to handle airway problems; including the ability to intubate, cardiopulmonary resuscitation, initiate and titrate vasoactive drugs, manage mechanical ventilation.
- When the patients are accompanied by specially trained transport teams, there are reduced number of complications. This is not possible in most Indian ICUs, we recommend therefore that at least all Level III ICUs should train personnel in transport of critically ill patients
- The transport personnel will remain with the patient until the patient is returned to the intensive care unit.
- Documentation of vitals and adverse events if any, during transport should be carried out. Similarly patient status during handing over care and back in the ICU should be recorded if the care is transferred.
- Appendix IV lists in details the training of personnel.

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7. Accompanying Equipment, Drugs & monitors.

- Appendix III lists the equipment and drugs required during transport of the patients. Certain principles should be followed when designating

equipment for patient transport.

- Ideally the equipment to be used during transport should be dedicated and should not be used anywhere else.
- In Indian scenario this may not be possible, however if equipment is to be shared during transport as well as during care in ICU, it should be portable so that it can be moved with patient. Use of modular systems can solve this problem to a certain extent.
- A person should be designated to look after the equipment when not in use.
- A regular check of the equipment and charging (if required for equipment such as defibrillators, infusion pumps, etc) is manadatory.
- Patients may be transported on the ICU bed itself or on special trolleys for transport.
- No equipment or drugs should be placed on the patient. Most units will have custom-made shelves which will fit on the beds or trolleys.
- The monitors and / or ventilators should be properly secured with straps to the bed or shelves so that they do not fall on the patient.
- These trolleys must be able to enter lifts and pass through all doorways en route to the destination.
- All battery-operated equipment should be fully charged and capable of functioning for the duration of the transport. If prolonged transport is anticipated, then the power should accessed from the mains at destination and the battery used during the journey back to the ICU.
- The equipment should be capable of working in the environment of intended destination such as the MRI.
- In most Indian hospitals, MRI compatible equipment is unlikely to be available. Each unit should find suitable local substitutes for monitoring and ventilation in such environment. In case it is not possible to use these substitutes and patient is too unstable to be left unmonitored or manually ventilated, transport should be deferred or cancelled or alternative modalities of investigation sought for.

8. Care during transport

- Ideally the patient should receive the same level of care as the pretransport area.
- Vitals should be monitored and recorded at fixed intervals. Use of memory-capable monitor should be used. This will allow documentation of data during transport.
- Any adverse events should be noted and emergently acted upon.
- There should be a designated intensivist available for consult in case of an adverse or critical event during transport.
- Ideally he / she should be on hand in the ICU and should be able to go to the destination area if required.
- The transport team should be able to communicate with designated person during transit as well as upon arrival at the destination in case of an emergency.

- Suggested monitoring during transit is detailed in Appendix III.

9. Care at destination

- If the patient is to be moved from the transport bed or trolley at the destination (such as to the CT table), care must be taken not dislodge indwelling airway and vascular devices.
- If prolonged procedures /scans are anticipated the mains should be accessed for power and the wall oxygen outlet should be used in place of oxygen cylinders.
- The patient must be assessed when gas and power supplies are re-established from different source (such as wall outlets for oxygen, compressed air).
- If another team assumes responsibility of care, a complete hand over is given to the team leader. Patient status should be documented at the time of hand over.
- The transport staff must remain with the patient until the receiving team is fully ready to take over care.
- When taking the patient back, a hand over takes place and again patient status should be documented.
- Even during transport the patient must receive all essential medications and doses should not be skipped just because the patient is being transported.

  Appropriately skilled physicians (such as neurosurgeons or orthopaedic surgeons) if required for the procedure (such as flexion-extension views of the C-Spine), should be available in time, at destination to carry out the intended procedures to avoid a delay at destination.

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INTERHOSPITAL TRANSPORT

Interhospital transport of the patients in Indian scenario presents a challenge because of lack of specialized transport teams such Medical Retrieval Units or Regional Transport teams. The entire responsibility of initiating the transfer, arranging the transport team, patient care during transport, organizing equipment, personnel and monitoring will rest with referring physician. Presence of written policy documents or guidelines, dedicated equipment and trained personnel will be useful to units undertaking interhospital transports often.

In Indian ICUs patients may need to be transferred to another hospital for:

- Further care when deterioration in patients' clinical condition is expected and facilities for the same are not available at the admitting hospital.
- For diagnostic or interventional purposes (such as CT scan or

Angiography) when these facilities are not available at the admitting or primary hospital. This scenario obtains quiet often in Indian ICUs and the patient will be transported back to the same ICU at the end of the procedure.
- Patient initiated transfer where patient or family does not desire further care.

The interhospital transfer can also be of

- Emergent type for acute life-threatening illnesses emergency interhospital transport may be needed due to either lack of diagnostic facilities, lack of staff and/or facilities for safe and effective therapy in the referring hospital
- Semi-emergent type for higher level of care or specialty service.

Initiating transport & preparing patient for transport

- The treating intensivist in consultation with primary physician (in open ICUs) will take the decision to transport the patient. The family is informed of the necessity and possible adverse effects of transport. The indication for transport, risks and expected benefit must be clearly documented in the medical records Patient's or the responsible person's (surrogate decision maker) informed consent should be taken in the standard format. Similarly the primary physicians' concurrence should be documented.
- The referring physician should always write an order to transfer the patient in the medical records.
- If patient is being transferred for further care, the receiving intensivist should be contacted directly and patient's clinical status communicated directly to him. He /She might have suggestions to make for improving patients stability, which may be undertaken before shifting the patient.
- In a life threatening emergency, when informed consent is not possible, the reasons for not obtaining informed consent and indication for transfer are documented in the medical record.
- While making the decision, the patient's clinical condition, urgency of the required diagnostic or intervention modality should be taken in to account.
- Nonessential testing and procedures at the referring ICU will delay transfer and should be avoided.
- If in doubt about the airway, patient should be intubated electively before transport. Intercostal drains are better inserted in the referring ICU than a moving vehicle.
- Patient preparation is similar to that described in the section on 'Intrahospital transport of critically ill patient'.
- In Indian ICUs, the transport team will often be arranged by the physician initiating the transfer. The team may be from the referring ICU or commercial transport ambulance may be asked to transport the patient.
- The intensivist and primary physician must make sure that the transport

team is competent to care for the patient during the entire transport. For example transport team accompanying a mechanically ventilated haemodynamically unstable patient must be competent in ACLS, managing airway emergencies and ventilation, etc.

- If non-urgent, the transport should be planned for morning to avoid peak traffic. This will also enable investigations to be done at the receiving hospital.
- The referring intensivist must confirm the availability of ICU bed and ventilator at receiving hospital.
- Confirm that the receiving hospital will not keep the patient waiting in the casualty room.
- To avoid delay at the receiving hospital, make sure that the patient's family is aware of the admission procedure at the receiving hospital, confirm amount of deposit, if any to be paid on admission. The required paperwork may be commenced in advance of transporting the patient.

^Top

Communication & coordination

- The destination hospital or referral center must be informed of the time when the patient sets off from the ICU, the expected time of arrival of the patient at the destination.
- The transport team must be able to be in constant contact with the referring intensivist and the destination hospital. They must inform and update the receiving hospital regarding ETA of the patient in case of delay on the way.
- The receiving hospital must ensure that on arrival, the patient is immediately taken up for intended investigation or intervention without delay to avoid wait at the destination. If being transferred for further care, the receiving hospital must ensure that the patient is directly taken up to the ICU without delay.
- The transport team must be aware whom to contact in an emergency in case of deterioration in the patients condition.
- The referring intensivist or a previously designated substitute competent person must be available to for consultation on phone and be able to reach the patient for help if possible.

  It should be decided in advance in case the referring doctor is too far away, whom the transport team can contact at the referral hospital in an emergency.

Selecting the mode of transport

- Mode of transport used will depend partly on clinical requirements, on vehicle availability, road conditions and on conditions at the referring and receiving sites.

- Choice of transport vehicle will be influenced by
    - nature of illness
    - possible clinical impact of the transport environment
    - urgency of intervention
    - location of patient distances involved
    - number of retrieval personnel and volume of accompanying
    - equipment road transport times and
    - road conditions range and speed of vehicle
    - For air transport: weather conditions and aviation restrictions for airborne transport aircraft landing facilities (discussed in detail in the section :Aeromedical Transport in Indian Scenario)
- Transport Vehicle Requirements. These are discussed in the section on ambulance specifications.

^Top

Care during transport

- Management during transport should be at least equal to the level of management at the referring ICU and must prepare the patient for admission to the receiving service.
- The instances when mishaps are most likely are
    - while shifting patient from hospital bed to ambulance trolley
    - shifting patient trolley in to the ambulance
    - Shifting trolley from ambulance at the receiving hospital.
    - During these intervals extra vigilance is needed to prevent disconnections, equipment malfunction and dislodgement of indwelling catheters.
- If the transport team does not belong to the referring hospital, ensure complete hand over of relevant clinical details. This hand over and patients clinical status should be documented in the patients medical records.
- Ensure that the all relevant imaging films, copies of medical records and investigation reports are given with the patient before beginning transport.
- In case patient is transported for investigation or intervention, ensure that consent for the procedure is obtained beforehand and it accompanies the patient.
- The patient trolley must be secured appropriately in the ambulance. If the patient is intubated and ventilated, patients head must be secured to prevent movement with the movement of the vehicle. Patient should otherwise be securely strapped to the trolley.
- Check that the ETT is secured properly. All monitoring leads, etc are attached properly and monitors are working. Make sure the alarms are set and are working.
- In ventilated patients, check that the ventilator is connected properly and is working. Confirm bilateral air entry and rule out hypoxia. 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.
- Ensure enough oxygen and battery backup for the duration of transport. (About 30 min. more than the transport is expected to last.
- The patient should be examined for haemodynamic stability before starting the vehicle.
- If the duration of transport is long, decide tentative location of halt (for staff toilet, snacks, patient's toilet and feed.) in advance.
- Ensure proper monitoring and maintain record of vitals. Make sure that the patient receives timely doses of all medications. Make sure that all infusions and drips are going and oral and endotracheal suction is carried out in timely manner.
- Driving should be slow and steady to avoid jerky movements.

Equipment, Drugs and monitoring.
Discussed in appendix III.

Accompanying Personnel

- The patient should be ideally accompanied by a physician, along with a nurse and a wardboy.
- All unstable patients and ventilated patients should be accompanied by a trained person, ideally a physician competent to handle airway problems including the ability to intubate, cardiopulmonary resuscitation, initiate and titrate vasoactive drugs, manage mechanical ventilation.
- In case a physician can not accompany patient a trained paramedic may accompany the patient. This person should have a way to urgently communicate with the previously designated person: either referring or receiving intensivist in case of an emergency.
- The transport personnel will remain with the patient until the patient is settled in the receiving ICU.
- Documentation of vitals and adverse events if any, during transport should be carried out. Similarly patient status during handing over care should be recorded.

Appendix V lists in details requirement of the training and ideal qualification of personnel during transport.

Care at receiving ICU.

- The receiving ICU should ensure that the patient is received immediately in the ICU on arrival.
- The patients' clinical status is assessed immediately and thoroughly, a relevant history & other details are obtained from the transport team and the hand over is documented.
- The personnel at the receiving ICU will exchange the equipments of the referring hospital or ambulance with that of the receiving hospital.

^Top

GUIDELINES FOR AEROMEDICAL TRANSPORT IN INDIAN SCENARIO

Since in India there are no hospitals with helipad facility yet (some hospitals are coming up with this facility soon), every aeromedical transport will involve minimum 3 steps

- Primary care centre to airport/helipad – Road ambulance
- Air transport – helicopter/fixed wing/commercial flights
- Airport /helipad to Referral centre- Road ambulance

Pre-transport coordination and communication

- Reliable and effective communication must be available at all times between transport team, referral hospital, receiving hospital, ambulance service at both ends and aeromedical service.
- Copies of qualifications must be carried by doctor transporting patient especially during international transport and it is advisable to have an appropriate insurance cover for the staff involved in aeromedical transport.
- When patients are transported by commercial flights, proper communication with airport and airlines crew is must. Number of seats to be reserved depends on size of transport trolley which is again provided by respective airlines but minimum 4 and maximum 6 seats need to be removed in order to accommodate the patient stretcher.
- The equipments that are carried while transporting the patient should be reported at customs counter to avoid further problems while returning back. Also it is advisable to transport patients during lean hours when air traffic is less to avoid delay.

Personnel who accompany the patient:

- A minimum of two people shall accompany the patient one of which must be a physician who is directly involved in patient care. If it is not possible for primary physician to accompany the patient, physician accompanying should spend sufficient time with primary physician and get well acquainted with patient's clinical condition. He/she should be trained in transportation of patient, resuscitation, airway care, ventilation and other organ support with appropriate training in anaesthesia, intensive care or emergency medicine and should have previous experience of patient transport. Those patients who have unstable physiology and might need active interventions should be accompanied by a physician and assisted by another suitably experienced nurse, paramedic or technician, familiar with intensive care procedures and with the transport equipment.

- It is preferable to have one close relative of the patient along with to give consent in case important decisions are to be made or in case of fatal outcome to take responsibility as ground transport can take lots of time ranging from several hours to days in our scenario. Since the space is problem especially in helicopter, these issues need to be thought of and settled prior to take off.

Documentation

- The clinical record should document reason for transport, patient's clinical status before, during and after transport, relevant medical conditions, and therapy given.
- A means of follow up after transport should be available as feed back

Vehicle

- For details please see Appendix.

^Top

Please see Appendix II for equipment, monitoring & drugs.

Preparation for transport

- Prior to departure, transport attendants who have not been involved in the initial care of the patient should familiarize themselves with the treatment already undertaken and independently assess the patient's condition.
- A full clinical assessment including a physical examination performed.
- Recent investigations including hematology and biochemistry results, X-rays and scans should be reviewed. The patient's identity bracelet should be checked and verified against any cross-match forms and blood products likely to be required during the journey.
- Meticulous resuscitation and stabilization of the patient before transport
- The airway should be assessed and if necessary secured and protected. Tracheal intubation and ventilation prior to transport are mandatory if there are any concerns about the integrity of the airway or the adequacy of ventilation.
- Intubated patients should normally be paralysed, sedated and mechanically ventilated.
- Inspired oxygen may be guided by arterial oxygen saturation (SaO2) and ventilation by end tidal carbon dioxide (EtCO2). Following stabilization on the transport ventilator, at least one arterial blood gas analysis should be performed prior to departure

to ensure adequate gas exchange. Inspired gases should be humidified using a disposable heat and moisture exchanging filter (HME).

- If a pneumothorax is present or likely, chest drains should be inserted prior to departure.
- Underwater seals should normally be replaced by leaflet valve (Heimlich type) drainage systems. Chest drains should not be clamped.
- Secure venous access is mandatory and at least two wide bore intravenous cannulae (central or peripheral) are required. A suitably secured indwelling arterial cannula is ideal for blood pressure monitoring.
- Hypovolemic patients tolerate moving poorly and circulating volume should be near normal prior to transport. This may require volume loading with crystalloid, colloid or blood, guided by central venous or pulmonary artery occlusion pressure monitoring and cardiac output measurement. If inotropes or other vasoactive agents are required to optimize haemodyanamic status, patients should be stabilized on these before leaving the referring unit.
- Patients who are persistently hypotensive despite resuscitation efforts should not be moved until stable. Continuing sources of blood loss or sepsis should be identified and controlled. Long bone fractures should be splinted to provide pain relief, cardiovascular stability and neurovascular protection.
- A nasogastric or orogastric tube and urinary catheter should be passed and free drainage allowed into collection bags.
- Patient with unacceptable hypoxia (SaO_2 < 70% to 80%) in 100% oxygen should get an empirical trial of a lower cabin altitude
- Strict requests for a low cabin altitude force the pilot to fly his aircraft at a lower altitude than planned. This increases the likelihood of encountering bad weather or turbulence. It also increases fuel consumption and flight time and may require additional refueling stops on long flights
- Anemia predisposes the patient to amplified effects of altitude induced hypoxia. Supplemental oxygen should be administered and appropriate cabin altitude maintained. Blood transfusions should be given prior to take off and continued during transport.
- For the crew and uncooperative patients with significant upper respiratory infection (URI) symptoms, a topical vasoconstrictor nasal spray or drops, 15 to 30 minutes before descent, may help prevent barosinusitis and barotitis media (pressure damage to sinuses and middle ear); sympathomimetic vasoconstrictors should probably be avoided in patients at risk for dysrrhythmias.
- Nasogastric tubes should always be vented or connected to suction because expansion of trapped gastrointestinal tract gases can cause pain and bowel ischemia.
- Patients who are transported by fixed wing aircraft and are receiving positive-pressure ventilation are at greatest risk for developing a tension pneumothorax (or pneumomediastinum or

pneumoperitoneum); therefore, the transport team leader must be prepared to make the diagnosis of tension pneumothorax on clinical grounds alone and treat the patient accordingly. If a thoracostomy tube is inserted into the pleural space prior to or during the air transport, it should be connected to a Heimlich valve and placed on continuous suction

- Plastic intravenous bottles should be used instead of glass bottles. Glass bottles can become hazardous missiles in turbulence and can explode under reduced ambient pressure
- Patient devices that can cause problems because of trapped gas expansion include: pneumatic splints, medical antishock trousers (MAST) suits, cuffed endotracheal tubes, intravenous reservoirs containing air, medication bottles containing air, bladder catheter balloons, sphygmomanometer cuffs, aortic balloons, and pulmonary artery catheter balloons. Each trapped gas pocket must be eliminated, vented, replaced with water, or compensated by pressurizing the cabin to sea-level altitude.
- Pneumatically powered and controlled ventilators may deliver increased flow rates, tidal volumes, and decreased machine breath rates. Volume ventilators may deliver decreased tidal volumes. Electronically controlled ventilators are less sensitive to altitude changes. But since electronic equipment need to be switched off during take of to avoid interference with signals, it is preferable to manually ventilate these patients during take off and landing.
- Humidifiers should be used with the ventilator circuit in order to compensate for the very dry ambient atmospheric conditions.
- Administration of 100% oxygen prior to aircraft ascent will washout nitrogen from the tissues and will prevent or minimize barotrauma symptoms.
- The appropriate approach on aircraft takeoff is to position the head of a hypovolemic and haemodynamically unstable patient facing the tail of the aircraft. Conversely, a patient in cardiogenic shock with pulmonary edema or in congestive heart failure should be positioned with his or her head toward the front of the aircraft.
- Prior to takeoff, the pilot should be advised to avoid a steep climb-out and tight turns
- Prior to landing, the patient should be turned in the opposite direction if possible
- The patient with simultaneous intracranial pathology and hypovolemia poses a dilemma in positioning (since decreased cardiac output can cause cerebral ischemia). The most reasonable compromise may be to position the head of the patient towards the tail of the aircraft, but elevate it at 45° in the midline
- Transport team personnel should not donate blood within 72 hours of the beginning of a shift. No medication that impairs judgment should be consumed within 8 hours of the start of duty. There should be a minimum of 8 hours between alcohol consumption and reporting for duty.
- The aircraft must be equipped with a 110 V/60 Hz inverter that can

provide continuous AC current for the medical equipment. Electrically powered critical equipment must be equipped with a battery backup with sufficient reserve to supply power during shutdown of the aircraft and transfer of the patient into or out of the ground vehicle. The amount of oxygen required for the transport should be calculated and then doubled

- Traction devices using hanging weights may cause serious injury or discomfort to the patient during the accelerations of the transport; therefore, other methods of stabilization should be used
- Fresh circumferential casts should be bivalved to prevent vascular compromise from continued swelling, particularly during prolonged transports
- Suction is a problem during aeromedical transport. Helicopters and fixed wing aircrafts dedicated to patient transport generally do have an inverter that provides 240 volts power supply on which regular suction machine works but planes that are not used for patients flying or transport using commercial flights generally can not supply adequate output for medical equipments. It is always advisable to clarify these points before hands. Always have one manual suction machine or suction machine that can work on battery (laerdel) standby to use in case of inadequate power supply.
- The most commonly used ventilators are Impact's Uni-Vent 750, Bird's AVIAN and BioMed Devices' Crossvent. The Uni-Vent 750 is a pneumatically and electronically powered and electronically controlled machine which offers CMV, AC and SIMV, and PEEP with an external valve. The Bird AVIAN is pneumatically and electronically powered and electronically controlled machine which offers CMV, AC, SIMV and CPAP. It is time or volume-cycled, also has an extensive alarm system, and has a complete set of monitors. These ventilators are specifically manufactured for aeromedical transport, are used all over the world and are also available in India.

^Top

Medico-legal aspects of Transport of the Critically Ill Patient

- Transport for imaging
- Intra-hospital transport from one area to another for continued care
- Inter-hospital transport

Transport for tests, procedures or surgery from the ICU

Responsibility of the ICU:

- The treating ICU physician must justify the need for the test and also how

the result could alter patient management.
- The risk of transporting a critically ill patient must be documented.
- The risk-benefit ratio should be in favor of transporting the patient
- The patient's family should be explained the risk, benefit and then allowed to participate in the decision to transport the patient for tests.
- The intensive care unit is responsible for ensuring safety of the patient during the transport to the area where the test is to be performed, and for transporting the patient back to the intensive care unit.

Care of the patient during the test, procedure or surgery:

- Care of the patient during the test, procedure or surgery will primarily be the responsibility of the department where the test, procedure or surgery is being performed.
- However, if trained staff is not available in the test or procedure area, the ICU staff that is accompanying the patient could share this responsibility.
- The details of all drugs administered and monitoring performed during the procedure or interventions must be documented clearly.
- Clinical status at the time of handing the patient back to the ICU staff must be documented and counter-signed by the physician from the section where the test, procedure or surgery has been performed.

^Top

Intra-hospital transport from one area to another

Transport of critically ill patients from an area providing less intensive care to an ICU

Responsibilities of the physician looking after the patient:

- Confirming with the ICU about bed availability and that the ICU is willing to receive this patient, before initiating the process of transport.
- Informing the ICU just before the patient is transported, so that the ICU can make necessary preparations to receive the patient.
- Ensure safety of the patient during transport to the ICU.
- Informing the patients family about the need to transport the patient
- Informing about the possible risks involved in the transport.
- Completing the patient transport form to document the patient's status when in the original location, including physical findings, vital signs, problems, devices and appliances in use, and drugs and fluids being administered before initiating the transfer.
- Completing on the transport form, the details of drugs to be continued during transport, monitors and devices to be used during transport, and any special precautions that were taken during transport.
- To hand over care of the patient to the ICU physician on arrival in the ICU.
- To counter-sign the transport form after the ICU physician has

documented the patient's status on arrival in the ICU and signed the form.

Responsibility of the receiving ICU:

- Advising the referring physician about any special precautions to be taken during transport, if he/she has seen the patient before being transported.
- For making necessary arrangements to receive the patient in the ICU.
- To make available all devices and monitors that would be required on transfer to the ICU, so as to minimize delay in providing necessary intensive care to the newly transferred patient.
- To document in the transport form the condition of the patient on arrival in the ICU.

^Top

Inter-hospital transport of a critically ill patient

This may be required for medical reasons, or patient-initiated requests.

For Medical Reasons

Responsibilities of the physician from the original location:

- Before initiating the process of transport, to confirm bed availability in the new hospital and that the ICU is willing to receive this patient,
- Informing the receiving ICU about current clinical condition of the patient just before the patient is transported, so that the ICU can make necessary preparations to receive the patient.
- Arranging for a transport team that will be able to take care of the patient during transport.
- Informing the patient's family about the need to transport the patient
- Informing about the possible risks involved in the transport.
- Completing the patient transport form to document the patient's status when in the original location, including physical findings, vital signs, problems, devices and appliances in use, and drugs and fluids being administered before initiating the transfer.
- Completing on the transport form, the details of drugs to be continued during transport, monitors and devices to be used during transport, and any special precautions that were taken during transport.
- To hand over care of the patient to the team responsible for patient transport.
- To counter-sign the transport form after the transport team has documented the patient's status on taking over patient care.
- To give contact details of the receiving hospital and physician to the transport team, so that the transport team can contact them if needed.

Responsibilities of the transport team:

- To take over care of the patient to be transported.
- Documenting on the transport form the vital signs and the condition of the patient at the time of taking over from the physician at the pretransfer location.
- Ensuring that drugs required to be continued during transport and monitors and devices to be used during transport are available, and any special precautions to be taken during transport are followed.
- To ensure that personnel with the requisite skills and experience are available during transport.
- Adequate equipment and drugs to be used for ACLS or ATLS are available during transport.
- To contact the ICU where the patient is to be shifted, just before commencement of transport.
- To periodically update the receiving ICU about the expected arrival time, the current location of the vehicle and clinical condition of the patient.
- To request for specialized personnel / equipment to be kept immediately available if the need has arisen during transport.
- Ensure safety of the patient during transport to the ICU.

Responsibilities of the receiving ICU:

- Advising the referring physician or transport team about any special precautions to be taken during transport, if he/she has seen the patient before being transported.
- For making necessary arrangements to receive the patient in the ICU.
- To make available all devices and monitors that would be required on transfer to the ICU, so as to minimize delay in providing necessary intensive care to the newly transferred patient.

  To document in the transport form the condition of the patient on arrival in the ICU.

^Top

Patient-initiated transfer

The responsibilities of the physician from the original location, transport team and the receiving physician are the same as in transfer for medical reasons, except for the following responsibilities, which will be borne by the patient and/or patient's family.

Responsibilities of the physician from the original location:

- Before initiating the process of transport, to get the contact details of the receiving physician and hospital from the patient/family and confirm bed availability in the new hospital and that the ICU is willing to receive this patient
- Informing the ICU just before the patient is transported, so that

the ICU can make necessary preparations to receive the patient.
- Helping the patient/family to arrange for a transport team that will be able to take care of the patient during transport.
- Informing about the possible risks involved in the transport.
- Completing the patient transport form to document the patient's status when in the original location, including physical findings, vital signs, problems, devices and appliances in use, and drugs and fluids being administered before initiating the transfer.
- Completing on the transport form, the details of drugs to be continued during transport, monitors and devices to be used during transport, and any special precautions that were taken during transport.
- To hand over care of the patient to the team responsible for patient transport.
- To counter-sign the transport form after the transport team has documented the patient's status on taking over patient care.
- To give contact details of the receiving hospital and physician to the transport team, so that the transport team can contact them if needed.

Responsibilities of the patient or patient's family

- Contacting the place where the patient is to be transferred, to confirm the availability of facilities, expertise and vacant bed to receive the patient.
- To give the treating physician in the contact details of the physician who will be looking after the patient in the new location
- To arrange for the transport team to look after patient during transport. This can be done in consultation with the treating physician.
- To sign the transport form indemnifying the treating physician from the responsibility of any events taking place during transport, since the weighing of the risk-benefit ratio of transport has been done by the patient and/or patient's family.

Responsibilities of the transport team:
These will be same as for inter-hospital transport for medical reasons

Responsibilities of the receiving ICU:
These will be same as for inter-hospital transport for medical reasons

^Top

APPENDIX I : PREHOSPITAL TRANSPORT

Prehospital transport is not actually within the ambit of this committee. It has been included here for the sake of completion. Principles of good care during transport are the same as intrahospital & interhospital transport of critically ill

patients. Prehospital transportation refers to transportation of a critically ill from their location (homes or site of injury or illness) to hospital. Unlike intra – inter hospital transport often there is limited time to stabilize the patient and regardless of the clinical status, patients have to be transported so as render medical assistance to them. In India, unfortunately centrally organized government funded prehospital transport is lacking or meager at best and these services are mainly provided by private organizations. As with other categories of transport, prehospital transport requires appropriate planning of transport, optimum utilization of communications, deployment of appropriately trained staff with essential equipment and effective liaison between referring, transporting and receiving staff. The details about ambulance specifications, equipment, drugs and monitoring during transport are described in Appendices II – V.

On site care

- Appropriate monitoring, record of vitals and documentation should be done at each stage of prehospital transport.
- The on-site personnel should be in continuous contact with the destination hospital for conveying the clinical status of patient and receiving instructions re care of the patient. This should continue during transport to convey new developments.
- Stabilization of vital signs, secure airway and IV access, secure all catheters and ensure appropriate monitoring before departure.
- Maximum time to be spent in stabilizing at site is 10 minutes except in extenuating circumstances.
- Ensure scene safety. Establish patient responsiveness. Manually stabilize the spine.
- Open the airway using head tilt/chin lift if no spinal trauma is suspected, or modified jaw thrust if spinal trauma is suspected.
- Establish and maintain a patent airway while protecting the cervical spine. Suction as necessary. Insert an oropharyngeal or nasopharyngeal airway adjunct if the airway cannot be maintained with positioning. (Note that the nospharyngeal airway is contraindicated in the presence of maxillary facial trauma)
- Evaluate breathing – Is patient breathing spontaneously? Are respirations adequate in rate and depth?
    - Look for:
        - Nasal flaring, cyanosis, rapid respiration (tachypnea), retraction, asymmetry of chest wall, open wounds or bruising of chest wall
    - Listen for
        - Breathing, abnormal breath sounds, stridor – indicates partial airway obstruction
    - Feel for
        - Rib fractures, Crepitus,
    - Pulse oximetry, if available
- Assist ventilation in inadequate respiration using a bag-valve-mask device with high flow, 100% concentration oxygen. Monitor for abdominal distention.

- If breathing remains difficult for the patient, and he / she has an obvious chest injury, refer to appropriate protocol for management of chest trauma.
- Assess circulation and perfusion:
    - Check for the presence of a pulse. If the patient has no pulse, begin CPR.
    - check rate and quality of pulse
    - Inspect for obvious bleeding
    - Check blood pressure
- Observe skin color and temperature, and in children – capillary refill time
- Control hemorrhage with direct pressure or a pressure dressing.
- If the patient is hypotensive, place the patient in supine position with head low position
- Assess mental status
- If spinal trauma is suspected, place a rigid cervical collar and immobilize the patient as appropriate.
- Initiate transport to a higher-level medical facility. Rescuers should begin transport no more than 10 minutes after their arrival on the scene unless extenuating circumstances exist.
- Splint obvious fractures of long bones.
- Provide O2
- Control of external bleeding
- Peripheral I. V. lines and fluid resuscitation
- In patients with non-threatening conditions who require IVs, only two attempts at IV insertion by one paramedic should be attempted in the field. If these attempts are unsuccessful, one additional can be made on the scene by the other paramedic on scene.
- Further IV attempts must be made once the patient has been loaded and is enroute. Any additional on scene IV attempts must have approval from medical control.
- All IV attempts are to be peripheral. The external jugular vein is considered a peripheral vein. Intraosseous infusions are permissible in children less than 6 years who are in cardiac arrest, status epilepticus or have severe trauma.
- Patients with life- threatening conditions should only receive IV attempts at the scene if they are entrapped and cannot be rapidly transported.
- Perform focused history and detailed physical examination en route to the hospital if patient status and management of resources permit
- Reassess patient frequently throughout transport

Contact medical direction for additional instructions.

In addition to the above instructions, providers trained beyond BLS may initiate the following treatments.

- Perform endotracheal intubation if the airway cannot be maintained by positioning or if prolonged assisted ventilation is anticipated. An assistant must maintain in – line cervical stabilization throughout this procedure. Use pharmacological adjuncts, such as lidocaine, sedatives, and paralytic

agents, to aid in intubations as permitted by medical direction.

- If intubation is made difficult by factors, such as clenched teeth, combativeness etc. perform a rapid sequence intubation, using a paralytic such as vecurnium or succinylcholine, of properly trained and authorized to do so by his or her physician medical director.
- If a tension pneumothorax is suspected by mechanism of injury and as evidenced by severe respiratory distress and / or absent breath sounds, perform needle decompression with a large bore needle at the second intercostals space over the third rib at the midclavicular line.
- Initiate cardiac monitoring. Treat cardiac arrhythmias as dictated by your standing orders.
- Obtain intravenous access using age-appropriate large bore needle and balanced salt solution, e.g. normal saline or lactated ringers. If the patient shows sign of shock, initiate intravenous access in two sites using large bore needles. Do not delay transport to obtain intravenous access; this can be done en route.
- Relative contraindications to pain relief (as per protocol) use; include a patient with hpyotension, altered level of consciousness, head injuries, or respiratory distress. Use as dictated by your standing orders otherwise.
- Patient transport or other needed treatments must be not be delayed for multiple attempts at endotracheal intubation. Intubation attempts should limited to 2 on scene attempts per paramedic before transporting the patient.

^Top

Management During Transport

- Continued support of cardio respiratory system
- Continued volume replacement as per the protocol
- Monitoring of vital signs
- Use of appropriate medications as ordered by the physician or as provided by written protocol
- Maintenance of communication with a physician or institution during the transfer
- Maintenance of accurate records during transfer.

Transport Destination (For Trauma Patients)

- Goal is to provide definitive treatment within the golden hour.
- Given an average activation and scene time a 30 minutes transport time will deliver most patients to an appropriate hospital within an hour of injury. This recognizes that some flexibility in the 30 minutes transport time is permissible if a major trauma victim can directly be transported to MTS, as definitive treatment at MTS is a desired goal, which is to minimize the time of injury to definitive treatment.
- Where a major trauma patients is less than 30 minutes of transport time

from MTS or surgical facility, the patient should be transported to that service bypassing other hospitals with the prehospital providers stabilizing the victim within the scope of their abilities.

- Where major trauma patient is more than 30 minutes from an MTS and the prehospital EMS cannot provide basic stabilization the patient should be transported to the highest designated trauma service accessible within 30 minutes.
- Where in an ambulance paramedics judgment the patient condition deteriorates to an life threatening condition, the patients should be transported to the nearest designated trauma service for stabilization with subsequent transport to a MTS at the earliest appropriate time.

If more than one referral hospital is available for transfer, the following guidelines are listed in order of priority for making appropriate destination selection.

- The receiving hospital has all medical redources to deal with the most serious life or limb threatening injury to the victim.
- Consideration should be given to the volume of cases handled by that hospital.

Transportation Time

- Transport time by road can vary according to time of day, traffic condition and distance. 30 minutes that determine the destination refers to estimate time from patient loading to arrival at trauma service. This should be flexible where a small increment in time means that the patient is delivered to a site with more advanced to avoid the subsequent transfers. The following times are recommended for the Retrieval Team. Response time – 10 minutes, Scene time = 30 minutes, Transport time = 30 minutes.
- In most rural areas patients will be more than 30 minutes away from possibly any trauma designated hospital. In such situations the patient should be transported to the highest designated trauma service in the least possible time.

Transport Destination (For Cardiac And Stroke Patients)

- For patients with a relative short distance to travel from the home or site of illness to a tertiary center with a 24 primary PCI service, immediate transferal might be an option.
- Transportation to the nearest hospital that offers 24-hour emergency cardiac care . The hospital should be staffed round-the-clock by physicians and nurses competent in (1) performing an initial evaluation,

including an ECG, (2) providing cardiac monitoring and ACLS, and (3) providing reperfusion therapy.

- Patients with less than 3 hours duration of symptoms can be transferred first for thrombolysis as there was no difference between streptokinase and transferal for primary PCI in patients with symptoms of < 3 hours duration (PRAGUE – 2 traial)
- Pts with MI who are at especially high risk, including those with tachycardia (>=100 bpm), hypotension (<= 100 mmHg) or signs of shock or pulmonary edema. Should be triaged to a center capable of PCI.
- Pre-hospital thrombolysis in special settings in which physicians are present in the ambulance or prehospital transport times are 90 minutes or longer, this therapeutic strategy should be considered.
- EMS personnel should triage patients of early stroke within one hour of onset of symptoms to hospital, which have specialized Stroke units to facilitate TPA therapy in early stroke.

^Top

APPENDIX II : AMBULANCE SPECIFICATIONS

Vehicles should be appropriate to the task in terms of design (including cabin environment) and equipment. Regular inspection and servicing of vehicles and on-board equipment is required. Ideally the ambulance should have following features:

- Driven by suitably trained personnel
- Able to carry up to four members of hospital staff in addition to ambulance crew
- Safety of both patient and staff
- Seats for staff should ideally be rear facing or forward facing (not side facing)
- Ramp, winch or trolley system designed to enable single operator loading
- Ideally patient trolley should be centrally mounted allowing all round patient access. Often mounted on one due to space constraints and for stability due to attachement to the side wall. Care should be taken to leave adequate space at head end for patient access and perform acute medical interventions.
- Stable comfortable ride with minimal noise and vibration levels
- restraints for stretcher, equipment and passengers
- Regular service and maintenance contracts
- Adequate suction may be foot powered or electrically powered.
- Good communication system both external and internal easy access for safe embarkation and disembarkation
- Standard 12-volt DC supply.
- 240-volts 50Hz AC power supply from an inverter or generator

- Recommended minimum output 750 watts. This is generally sufficient to power a portable ventilator, monitor and infusion pumps
- Minimum of two standard 3 pin 13 amp outlet sockets in the patient cabin
- Minimum of two F size oxygen cylinders in secure housings. Oxygen supply should be in excess of 30 minutes of the estimated transport time. This can be calculated by the formula: Contents L / Gauge Pressure = Capacity L / Service Pressure. This will give total amount of oxygen. Then taking in to account the flow rate per minute, time the oxygen will last can be calculated.
- Manifold system with automatic cylinder change over, and audible oxygen supply failure alarm
- Minimum of two wall mounted outlet valves for oxygen (Oxygen concentrators may be an alternative)
- Medical air supply is also desirable but the space required by additional cylinders or compressors may be a limiting factor
- Adequate lighting, heating, air conditioning and humidity control
- Acceptable noise and vibration levels and noise protection for passengers. auditory patient monitoring alarms routed through attendants' headsets where noise is unavoidable, in addition to usual visual alarms
- adequate speed and response times

In India, following vehicles provide adequate space to fit above specifications.

- Tempo Traveller
- Swaraj Mazda
- Tata 407 (Body Built)

APPENDIX III: EQUIPMENT, DRUGS & MONITORING DURING TRANSPORT

Equipment

- Equipment must be robust, lightweight, and battery powered.
- All equipment should be dedicated for the purpose of transport and should not be used elsewhere.
- The equipment requiring charging should be kept continuously charged with spare fully charged batteries available.
- A designated person should be responsible to look after, check over the equipment periodically.
- Drugs should be checked periodically for expiry and replaced immediately when expired or used for a patient.

^Top

Respiratory Support Equipment

- Airways (range of oral and nasopharyngeal airways and a range of laryngeal mask airways)
- Oxygen, masks, nebuliser
- Self-inflating hand-ventilating assembly, with PEEP valve
- Suction equipment of appropriate standard, preferably two: foot powered and electrically operated.
- Portable ventilator with disconnection and high pressure alarms
- Intubation set (including a range of laryngoscope blades and endotracheal tubes)
- LMA should be available in case of an accidental loss of airway.
- Emergency surgical airway set (Cricothyrotomy)
- Pleural drainage equipment –Intercostal Catheters & underwater seal bottles
- Oxygen supply in excess of that estimated for the maximum transport time.
- Handheld Capnometer
- Preferably a Spirometer to measure to minute ventilation.

Circulatory Support Equipment

- Monitor/defibrillator/external pacer combined unit.
- Pulse oximeter
- Aneroid sphygmomanometer (not mercury-containing) with a range of cuff sizes
- Vascular cannulae, peripheral and central
- IV fluids and pressure infusion set
- Infusion pumps
- Arterial cannulae
- Arterial monitoring device (pressure transducer)
- Syringes and needles (a needleless system would be ideal)
- Pericardiocentesis equipment
- A sharps disposal container and a bag for biological refuse

Other Equipment

- Nasogastric tube and bag
- Urinary catheter and bag
- Nasal decongestant spray
- Instruments, sutures, dressing, antiseptic lotions, gloves
- Thermal insulation and temperature monitor
- Splints and equipment for spinal and limb immobilisation
- Neonatal/paediatric/obstetric transport equipment when applicable
- Dressings, bandages, slings, splints and tape

- Cutting shears and portable torch
- Gloves and glasses for staff protection
- Warming blankets
- Plaster cutters
- Portable torch

^Top

Transport ventilators
If a transport ventilator is used, it should

- Have sufficient portable power supply for the duration of transport

- Have independent control of tidal volume and respiratory frequency
- Be able to provide full ventilatory support as in assist-control or intermittent mechanical ventilation (not necessarily both);
- Deliver a constant volume in the face of changing pulmonary impedance;
- Monitor airway pressure;
- Provide a disconnect alarm;
- Capable of providing PEEP;
- Provide an FIO2 of 1.0.

DRUGS

Adenosine, 6 mg/2 mL	Nitroglycerin injection, 50 mg/10 mL
Amiodarone, 150 mg/3 mL	Nitroglycerin tablets, 0.4 mg (bottle)
Atropine, 1 mg/10 mL	Nitroprusside, 50 mg/2 mL
Calcium chloride or gluconate, 1 g/10 mL	Norepinephrine 2 mg/mL
Dextrose 25%, 10 mL	Normal saline, 30 mL for injection
Dextrose 50%, 50 mL	Phenobarbital, 65 mg/mL or 130 mg/mL
Digoxin, 0.5 mg/2 mL	
Diltiazem, 25 mg/5 mL	Phenytoin 100 mg/mL
Diphenhydramine, 50 mg/1 mL	Potassium chloride, 20 mEq/10 mL
Dopamine, 200 mg/5 mL	Procainamide, 1000 mg/10 mL
Epinephrine, 1 mg/10 mL (1:10,000)	Sodium bicarbonate, 5 mEq/10 mL
Fosphenytoin, 750 mg/10 mL (500 PE mg/10 mL)	Sterile water, 30 mL for injection
	Terbutaline, 1 mg/1 mL
Furosemide, 100 mg/10 mL	Verapamil, 5 mg/2 mL
Glucagon, 1 mg vial (powder)	Crystalloids: NS & RL 500 mL/1000 mL
Heparin, 1000 units/1 mL	
Isoproterenol, 1 mg/5 mL	Colloids: Starches and Gelatins 500 mL
Labetalol, 40 mg/8 mL	
Lidocaine, 100 mg/10 mL for infiltration	The following specialized/controlled medications are added immediately before transport as indicated
Lidocaine, 2 g/100 mL préservative free	
Mannitol, 50 g/50 mL	
Magnesium sulfate, 1 g/2 mL	
Methylprednisolone, 125 mg/2 mL	Narcotic analgesics (e.g., morphine,

Metoprolol, 5 mg/5 mL Naloxone, 2 mg/2 mL	fentanyl) Sedatives/hypnotics (e.g., lorazepam, midazolam, propofol, ketamine) Neuromuscular blocking agents (e.g. succinylcholine, pancuronium, atracurium, rocuronium) Prostaglandin E

Monitoring During Transport
Considering the various levels of ICUs in India, we recommend that following levels of monitoring should be provided during transport of patient. The monitoring standard should be at least equal to that provided in the pretransfer location.

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

- Non-invasive Blood pressure (level 1);
- Heart rate (level 1);
- Respiratory rates (level 1 in pediatrics and level 2 in other patients).

In selected patients (according to clinical status of the patient)

- Capnography (level 2);
- Continuous measure of the blood pressure (level 3); In haemodynamically unstable patients and patients on infusions of inotropes (Level 2)
- Measure of the pulmonary artery pressure (PAP) (level 3);
- Measure of intracranial pressure (ICP) (level 3);
- Intermittent measure of Central Venous Pressure (CVP) (level 3);
- Airway pressure (Paw) in intubated and mechanically ventilated patients (level 1 in these situations)

^Top

APPENDIX IV - TRAINING OF PERSONNEL

- Good medical care during transport is the direct result of proper training, expertise and experience of the accompanying personnel.
- Personnel engaging in the transportation of critically ill patients should be selected and trained in the various aspects of patient transportation.
- Personnel should attend trauma support programmes and transportation and BLS regularly ideally every 2 years.
- All ambulence personel including drivers should have minimum BLS training.
- Leadership qualities are important in personnel undertaking transport. Ability to communicate effectively, and to function as part of a team is essential.
- The physician accompanying unstable patients should be an experienced doctor competent in resuscitation, airway care, ventilation, and other organ support. The doctor, should ideally have training in intensive care, have carried out previous transfers, and preferably have at least two years' postgraduate experience. The doctor can be an anaesthetist, emergency medicine physician, an intensivist or a pediatrician (in case of pediatric transports.)

Training of Personnel:

The personnel should undergo any of the following programs depending on the kind of patients they are going to transport. All these programs may not be available all over India. In that case an equivalent course or training should be undertaken.

- BLS and ACLS/PALS or equivalent available locally.
- Basic & Advanced Trauma Life Support (BTLS & ATLS) or equivalent.
- The ISCCM can design a module and allow its local branches to conduct certified courses for training of manpower.