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Standard Operating Procedures
for the Safe Transportation of Clinically Ill Children
Second Edition
2021

Sultanate of Oman

Ministry of Health

Directorate General Primary Health care

Department of Woman and Child Health

Acronyms:

ABC	Airway, Breathing, Circulation
ABCDE	Airway, Breathing, Circulation, Disability, Exposure
ACLS	Advanced Cardiovascular Life Support
ACCEPT	Assessment, Control, Communication, Evaluation, Preparation and packaging, Transportation
A&E	Accident and Emergency
BP	Blood Pressure
CBC	Complete Blood Count
ECG	Electrocardiogram
EMS	Emergency Medical Services
ETT	Endo-tracheal Tube
Kg	Kilograms
ICP	Intracranial Pressure
ICU	Intensive Care Unit
IV	Intra venous
Lpm	Liters per minute
Mg	Milligrams
MIS	Management Information System
ml	Milliliter
mm	Millimeter
MoH	Ministry of Health
NETS- UK.	Newborn and Pediatric Emergency Transfer Service - United Kingdom
NRP	Neonatal Resuscitation Program
NPO	Nothing per os = nothing by mouth
NG	Naso-gastric
PALS	Pediatrics Advanced Life Support
PEEP	Positive End-Expiratory Pressure

PHC	Primary Health Care
PICU	Pediatric Intensive Care Unit
PRO	Public Relationships Officer
RAFO	Royal Air Force of Oman
ROP	Royal Oman Police
SCBU	Special Care Baby Unit
TGA	Transposition of the Great Arteries

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Contents

1.1 Purpose

Transferring patients from one hospital to another is an integral part of any medical delivery system. Adverse effects may occur during transfer, particularly when transfer conditions are sub-optimal. Although there is no data available on morbidity and mortality related to transporting critically ill children in Oman, the difficult and diverse geography of the country, the centralization of specialized child health services in the capital and the adverse outcomes noted in some transported cases, are important reasons for organizing the transport process. This matter was taken up by the Ministry of Health (MoH) and the training of health care professionals was initiated in 2011, in conjunction with Newborn and Pediatric Emergency Transfer Service - United Kingdom (NETS-UK). The purpose of this document is as follows:-

a) To ensure safe and timely transport of neonates and children requiring urgent or controlled transfer from one level of healthcare to another.

b) To ensure that all health care facilities have the following active components:

- A dedicated transport team
- Healthcare personnel trained on advanced life support (Neonatal Resuscitation Program (NRP), Pediatrics Advanced Life Support (PALS) or Advanced Cardiovascular Life Support (ACLS)).
- Personnel trained on safe transport of critically ill children.
- Management information system (MIS).
- Suitable and functional transport equipment.

c) To equip health care providers with the knowledge and skills to:

- Define a child with a critical condition and the need for their transfer to another facility.
- Ensure the availability of transport equipment.

1.2 Scope

This document provides the standard operating procedures in the transfer of all sick children that require medically assisted transfers at all levels of healthcare.

**Please note: Definitions where necessary, have been included in the procedure.*

Policy for Organization of the Transport Process

The policy for the transfer of critically ill children, takes into account the various aspects of the process, such as the transport team, the transport equipment and the mode of transfer.

2.1 Transport team:

a) It is recommended that every secondary level health care facility must have a core group of health care workers who are trained and able to perform the transport. This group constitutes of individuals that are competent in all the following:
   i. Pediatrics Advanced Life Support (PALS)
   ii. Neonatal Resuscitation Program (NRP)
   iii. Completed the course on "Safe transport of critically-ill children."

b) It is recommended to involve the biomedical engineer in the core group of transport.

c) The Head of Pediatrics Department at each hospital should lead the core group to ensure that there is as appropriate organization of the transport process, adequate supervision of training the team members, ensure availability of equipment, organizing transport duty rotations and other related logistics.

d) For urgent cases, a minimum of two people should accompany the patient. A doctor and a nurse competent in advanced life support skills should accompany a critically ill or intubated child.

e) The specific roles of the physician and nurse are outlined.

Table 1:Roles and Responsibilities of Transporting Team (Physician and Transporting Nurse)

Role of the transporting physician	Role of the transporting nurse
a) Team leader- Overall control of the transfer process. b) Communicating with the receiving center and ensuring approval for transfer from consultant in charge. c) Informing parents about the transfer and explaining to them the associated risks and benefits. d) Taking charge of the clinical care of the child and ensuring continuity of critical care. e) Filling necessary documents. f) The physician should also be well trained in obtaining and securing an airway, bag mask ventilation, and obtaining vascular access, including obtaining Intraosseous access. g) Prescribe/ administer necessary medication during transfer.	a) Skilled in the nursing care of critically ill children including monitoring pediatric patients, administrating medications, maintaining temperature control and providing general nursing care. b) Ensure all equipment are available and functional prior to the transport. c) Ensure all transport drugs are available with known concentrations before and during the transport. d) Be familiar with all the forms required and ensure that they are filled appropriately before, during and after the transfer process.

2.2 Transport equipment:

Equipment is divided into three categories:

a) respiratory equipment
b) monitoring equipment, and
c) transport medications

It is the responsibility of the nurse in charge of the Accident and Emergency (A&E) Department in each shift to make sure that the all the required equipment is available and functional (Annex 1).

2.3 Documentation and recording:

All relevant information of the child's condition must be documented in the appropriate forms including the Pediatrics Patient Transfer Form (H/P-249) (Annex 2) and Guideline for Filling up Pediatrics Patient Transfer Form (H/P-249) **(**Annex 3).

2.4 Modes of transporting of critically ill children:

In Oman, critically ill children can be transferred by road, air or sea, or a combination of these modes may be used as deemed appropriate considering the following:

- *Urgency*
- *Distance from the nearest suitable healthcare facility*
- *Terrain*

2.4.1 By Road: This is the most preferred mode of transporting a critically ill child owing to it being low cost, having rapid mobilization, being less weather dependent, and easier to mobilize, monitor and manage the patient than when using other modes of transport for this purpose.

2.4.2 By Air: The main mode of air ambulance transportation is via helicopter, due to its accessibility in terrains inaccessible by road, limited requirements for landing space, and feasibility in the event of emergencies or adverse weather conditions.

a) Transfer of a patient by helicopter should be considered in the following situations:

i. A patient with critical injuries or illnesses requiring transport to a distant healthcare facility within the country, whereby ground transport will significantly delay care leading to a worse prognosis.

ii. The patient is currently located in an area that is inaccessible to ground transport (e.g., patient trapped in a wadi, mountain or island).

b) Considerations for Rotary-wing Air Ambulance:

The following are the considerations while transporting a child via the air ambulance:

i. *Is there a helipad in the receiving hospital campus?*
   If not, the receiving hospital should be prepared to send a medical-escort team and ambulance to escort the patient from the airport or Royal Air Force of Oman (RAFO) airbase.

ii. *What are the current and predicted weather situations along the transport route?*

iii. *Is the weight of the patient (plus the weight of required equipment and transport personnel) within the allowable range for air transport?*

iv. There are various clinical conditions that may warrant helicopter transfer. Although the referring and receiving staff may agree on the transfer, the escort-physician of the specialized retrieval team is responsible for the final decision whether the patient is transferrable or not.

v. To initiate helicopter transfer, the referring physician shall discuss the case with, and seek clearance from his hospital director. The referring physician shall also telephone the consultant at the receiving hospital, provide all the clinical details as in Annex 2 and seek approval for transfer.

vi. The referring hospital shall then call Royal Oman Police (ROP) Hospital and discuss the case with the Emergency Medical Services (EMS) doctor on call to justify the need for helicopter transfer. If the ROP doctor approves the transfer, he will contact the ROP helicopter service to make the further arrangements.

vii. For picking up a casualty from an accident site or to rescue from remote areas, usually the ROP is already involved. They make the arrangements for helicopter-transfer (if road-transfer by ambulance is not the preferred choice), get approval from the Police Headquarters, which in-turn notifies the receiving hospital. In Musandam, RAFO is usually involved in transport of patients by helicopter.

viii. While preparing patients for helicopter transfer, special attention shall be given to immobilization in case of head, neck, spine, chest and abdomen trauma. The relatives normally do not accompany the patient in the helicopter.

ix. The official from (ROP) / RAFO shall notify the Duty Director at the receiving hospital regarding the expected arrival time of the helicopter landing.

x. The Duty Director shall arrange for the helipad lights to be switched on and shall notify the receiving clinical unit doctor and the A&E doctor/nurse in-charge so that the ambulance and medical escorts are dispatched to helipad area before arrival of the helicopter.

xi. The medical escorts receiving the patient being transported by helicopter shall carry with them all necessary medical equipment, devices and consumables which are required to manage the patient based on the clinical condition of the patient. The stretcher materials shall be securely fastened so that they are not blown off or sucked upwards during the helicopter landing. The ambulance and medical escorts shall approach the helicopter only after receiving clearance from the helicopter crew.

xii. Hospitals which have a helipad shall ensure that at all times, (a) the helipad is litter-free and clean; (b) no vehicles or material are stationed in the helipad area and immediate vicinity; and (c) the road leading to the helipad is not blocked in any way.

xiii. If the referring hospital has sent its staff as medical escorts, on arrival by helicopter, the receiving hospital shall provide the escorts with meals and accommodation or provide a vehicle for staff to proceed to the guest house / hotel arranged by the respective region.

2.4.3 By Sea:

Specific Procedures for Transferring Patients by Sea:

a) This applies to healthcare facilities in the coastal area with limited or no road access to transfer patients within Musandam and Masirah, but have the facility for ferry service between these islands and the mainland.

b) The secondary care receiving facility in Musandam shall send an escort team to receive the patient from the primary healthcare (PHC) center.

c) The ambulance boat service provides transfer of patients from Kumzar and Leema Health Centers to Khasab Hospital. The boat driver and crew shall be responsible for:

   i. Scheduled preventive maintenance of the ambulance boat.
   ii. Availability of the boat round the clock for emergency transfers and referrals.
   iii. Directing and assisting in loading and off-loading the patient keeping in mind the sea and boat dynamics.
   iv. Ensuring alignment of the patient and crew in the ambulance boat.
   v. Ensuring that all safety measures are observed, including wearing of life jackets by all occupants of the boat.

Procedure for Structured Approach to Transfers

3.1 The ACCEPT Model:-

This guideline aims to streamline the transfer process using a systematic approach called the **ACCEPT** model. This model emphasizes the importance of preparing the child prior to transport and ensures that appropriate assessments and procedures are carried out before, during and after the process is completed.

The components of the **ACCEPT** model are:

A:	**Assessment**
C:	**Control**
C:	**Communication**
E:	**Evaluation**
P:	**Preparation and packaging**
T:	**Transportation**

3.1.1 Assessment:

This first step is carried out prior to transporting a patient. At times the transporting physician has no prior knowledge of the patient to be transported. Proper assessment requires taking into consideration both the child's clinical condition including vital signs (please refer to Annex 4 for vital signs range per age) as well as the competencies of the transferring team. Answering the following questions may aid the process:

Assessment Questions:

- *What is the problem?*
- *What is being done?*
- *What effect is it having?*
- *What is needed now?*

After obtaining the history carefully, an **ABCDE** approach should be adopted to identify the immediate and predicted needs of the child (please refer to Annex 5 for a summary).

a) Airway:

- Will it be possible to assess the airway during transfer?
- Is there a member of the team present who can secure the airway, if required?

If the child is intubated:

- Is the endotracheal tube (ETT) tube visible?
- Is the length of the tube at the lips/nose recorded?
- If cuffed, is the pilot balloon visible?
- Are the connections to the ventilation tubing visible?
- Is the ventilator tubing secured to ensure that it will not pull the ETT tube out? Does a member of the team have easy access to a prepared pack of the drugs and equipment that might be needed to (re)intubate?

b) Breathing:

- Is sufficient oxygen available for the transfer?
- Is a self-inflating bag–valve–mask system with appropriate size mask readily available if required?

If the child is ventilated:

- Do you have visual and hands-on access to the ventilator and the breathing circuit?
- Is there symmetrical chest movement?
- Can you see the pulse oximeter and capnograph displays?

c) Circulation:

- Can you assess the child's circulatory situation?
- Do you have an adequate intravenous access?
- Can you respond to changes in the child's circulatory status (inotropes/ volume)?

d) Disability:

- Does the child require analgesia?
- Assess the child's neurological status in the ambulance.
- Plan how the team will respond to changes in the child's neurological status.

e) Exposure and environment:

- Has the child been kept warm during assessment and stabilization?
- Is the child adequately covered and secured (on stretcher or incubator)?
- Is the monitoring and therapeutic equipment adequately secured?
- Are all personnel going to be adequately secured?

3.1.2 Control:

This is the process of ensuring that each member of the transport team is familiar with his/ her responsibilities and duties, that all tasks are organized, all equipment is in good working condition and drugs used during transport are available. Control comprises of two main processes; task identification and task allocation.

a) Task identification:

Once control has been established:

- Provide direct clinical care.
- Communicate with concerned personnel.
- Identify and assemble necessary resources like staffing, equipment and drugs.
- Fill out necessary forms.

b) Task allocation:

The team leader should allocate tasks among team members, taking into consideration the relative priority of each task and the competencies of staff.

3.1.3 Communication:

The successful transfer of an ill patient from one clinical area to another requires the coordinated efforts of individuals from different teams. Communication begins at an individual level as soon as the initial referral has been received. The following section will highlight key elements of successful communication.

a) Involved personnel:

i) From the referring hospital:

- Consultant in charge.
- Clinicians at bedside.
- Referring doctors/nurse.
- Nurse in Charge.
- The child's parents/relative.
- Ambulance driver.

ii) To the receiving team:

- Consultant in Charge.
- Receiving Doctors.
- Receiving nursing staff.
- Emergency department.
- Others (PICU, SCBU)

b) What needs to be communicated?

Successful communication occurs when all necessary information has been passed on and understood by all relevant people. Communication of each case should consist of the following:

i) Who are you? (Name and designation).
ii) What is needed? (From the listener).
iii) Relevant details of the child: Primary and secondary diagnosis, laboratory investigations, radiological investigations and other relevant clinical details.
iv) Main interventions/ procedures carried out at the referring hospital.
v) What is needed from the listener?

1. Plan what to say before calling.
2. Be systematic in passing the information and ensure clarity of the connection.
3. Summarize the situation and repeat what you need from the listener at the end.

c) Communication with parents:

i) Transferring a sick child can be a stressful event for parents and families leading to a variety of emotions including stress, anxiety, anger or fear of the uncertain. Showing compassion and understanding is key. The transferring team must explain to the parents the situation of the child, what complications may occur during the transfer and what is expected to happen to the child at the receiving facility. Messages should be clear, precise and open. Speculation and unrealistic assurances should be avoided.

ii) Respect parental wishes and expectations whenever possible provided they cause no harm to the child. Cultural and religious views should also be considered when talking to the parents.

iii) If Arabic is not the first language of the caring physician, a suitable interpreter can be sought.

iv) In cases of parental refusal for transfer involve the following in order; senior physician, hospital administration and the Public Relationship Officer (PRO) to ensure that the patient receives the necessary care.

3.1.4 Evaluation:

Evaluation is a dynamic process that starts from the first contact with the child. The main aim of evaluation is to decide on the appropriateness and urgency of the transfer. The urgency of transfer is categorized as follows:

a) Emergency (critical time):

i) **Stable:** A child in this group would have a secured airway, be clinically stable and have good intravenous access. No obvious danger of cardiorespiratory collapse should be evident.

ii) **Unstable:** Children in this category pose the greatest threats. However, at times, these children may become stable with appropriate interventions. Once all efforts of stabilization are exhausted the team leader should communicate with both receiving and referring consultants to decide if it is appropriate to transfer the child or not.

b) Urgent:

i) **Stable:** Admitted with an acute problem and stabilized by the local team. Most neonatal transfers fall under this category.

ii) Unstable: These children may require admission in High Dependency Unit rather than ICU care but may carry a potential risk of deterioration.

c) Elective: Transfer of a stable patient for a second opinion or further investigations.

Table 2: Urgency of Transfers

Category of clinical incident		Urgency	Driving mode	Personnel
Emergency	Unstable	Time is critical mobilize team in <30 mins	Use of blue lights and sirens	A physician and nurse competent in transport
	Stable	Time is critical mobilize team in <30 mins	Use of blue lights and sirens	A physician and nurse competent in transport
Urgent	Unstable	Transfer within 4 hours	Use of blue lights and sirens Normal speed limits	A physician and nurse competent in transport
	Stable	Transfer within 4 hours	Normal speed limits	A physician and nurse competent in transport
Elective		Arranged 1-2 days in advance	Normal road speeds	Transport nurse or a physician depending on the case

3.1.5 Preparation and Packing:

Although it is not possible to provide all critical care management modalities during a transfer, the standards of monitoring and care must not be compromised. In order to achieve this both the current needs of the child and the potential needs must be thought of and accounted for. This process normally includes two components: preparation and packaging:

a) Preparation: There are three distinct components to this step:

i) **Child preparation:** The child must be stabilized to reduce any complications.

ii) **Equipment Preparation:** All necessary equipment must be identified and checked.

iii) **Personnel Preparation:** All personnel who are to undertake the transfer must be prepared.

i) Child preparation:

The team leader must ensure that the child is in the best possible condition before transporting the child and that all team members are fully briefed. It is useful to use the ABCDE approach.

- Make sure the child has a definitive airway. If there is any doubt about the child's ability to breathe, an elective intubation is warranted. A decision to omit intubation in this case must involve the consultant in charge of receiving the case. Ensure the ETT is well secured, the formula to calculate ETT size is: age /4+4 and the formula to calculate the ETT length is: age/2 +12 cm (oral), age/2 +15cm (nasal).
- If the child is breathing spontaneously, a non-rebreathing mask with high flow oxygen can be used. Conscious children are best transferred sitting up accompanied by a parent.
- Ensure good IV access prior to transport. Two peripheral access points or one sutured central access is preferred. An infusion pump is recommended. Infusions should be rationalized to reduce their number to a minimum. If necessary, sedatives or muscle relaxants can be given as boluses, some may be mixed in one syringe.
- Children may have temperature instability during transfer. Ensure appropriate measures to prevent hypothermia.

***Note:** Any suspicion of spinal injury warrants taking appropriate measures to ensure spinal immobilization during transfer. Such measures would include using a size appropriate hard collar and spinal boards which should be secured to the ambulance stretcher. Simple measures such as bags of fluids placed either side of the child are not suitable for transfer.*

ii) Equipment Preparation:

- Transport equipment should not be used for other purposes; it should be stored in a specific location and must be checked regularly. Monitors and pumps must be kept charged at all times.
- Supplies of drugs and fluids should be more than adequate for the whole intended journey (Annex 6, 7).
- Make sure all documents, films, investigations and transfer forms are taken.

- It may be useful to keep a loading check list and use multi-compartment bags.

iii) Personnel Preparation:

- All personnel should be familiar with the relevant transfer procedures and the equipment to be used, as well as the details of the child's condition.
- Staff should have appropriate life support skills for both the current and possible needs of the child.
- Staff should be equipped with methods of proper communication.

b) Packaging:

Packaging is defined as the process of making sure that the child and all the equipment is protected and secured. Appropriate measures to minimize the deleterious effects of the hostile environment should be undertaken.

i) **Packaging the child:**

The key element in packing the child are security and accessibility:

- Any endotracheal tube (ETT) must be secured. In children this means fixation with an adhesive tape (box below). Excessively long tubes may kink especially when attached to a ventilator. The ETT should never be cut until a chest x-ray is taken to confirm that it is long enough.
- The ETT should always be protected to prevent extubation. There is always an increased risk when moving a child from a bed to a stretcher, or incubator to transport incubator.
- **If the atmospheric pressure is likely to change significantly during air transport, the ETT cuff should be filled with water not air to prevent tracheal injury through volume changes during altitude.**
- The eyes of the sedated child must be protected by closing the lids with tape, this will prevent accidental corneal abrasion. Make sure to assess the pupils regularly to evaluate levels of sedation and signs of raised intra-cranial pressure (ICP).

ii) Packaging the equipment:

- A reserved oxygen supply must be readily in hand and should have an appropriate connector attached.
- Adequacy of respiratory support is assessed by a pulse oximetry, the probe can be placed on a finger under the blanket, because it is more likely for the probe to work well in this low light.
- One point of venous access should be kept easily available for administering drug and fluids. All the intravenous lines must be secured before transfer. Peripheral lines should be fixed with adhesive dressing. The part covering the entry point of the cannula must be transparent and should be regularly inspected for any signs of extravasation. Bandages that completely cover the cannula must not be used. Central venous lines should be sutured in place and covered with a transparent, adhesive dressing. The access port can be secured to the shoulder of the child to avoid displacement during transfer.
- Heat loss resulting in hypothermia presents a major problem during transfer. It can be substantially reduced by wrapping the child in a pre-warmed blanket.
- Checking of ventilator and associated equipment needs to be done thoroughly before transfer.

3.1.6 Transportation:

All critically ill patients should receive the same level of monitoring available in the Intensive Care Unit (ICU) including at minimum continuous ECG, pulse oximetry and periodic measures of blood pressure, heart rate and respiratory rate. Before leaving the referring unit ensure you have done the following:

- If the child is breathing spontaneously, change to transport oxygen supply and ensure that the mask is of appropriate fit.
- Ensure that the transport oxygen cylinder is full and has the appropriate valve connected.
- If requiring ventilation, attach the child to the transport ventilator to ensure adequate ventilation and oxygenation; if possible, check the blood gas after 15 minutes.
- Ensure adequate chest rise via auscultation.
- Ensure that any chest drain present is secure and functioning.

- Hang any fluid bags so that they do not interfere with the transfer of the child.
- Check the position of the urinary catheter ensuring that the tube is not kinked.
- Check the position of the naso/orogastric tube.
- Plan the move with the team.
- Brief the child's parents - give them the opportunity to see and touch their child.
- When appropriate, brief the child.
- Check that no line or tube is likely to be snared in the move.
- Move the child to the trolley using appropriate aids.

Measures below should be considered in the transportation process:

a) Sedation and pain management:

It is easier to maintain the patient's ventilation during transport if the patient is kept well sedated. Paralysis is used in case sedation alone is not enough to control patient' s agitation. This precaution minimizes the chance that the endotracheal tube gets displaced accidentally.

The following medications can be used for the purposes of sedation, paralysis and pain management as summarized in the table below:

Table 3: Sedation, paralysis and pain management to be used during transfer.

Drug	Dose	Common side effects
Pancuronium Bromide	0.2 – 0.1 mg/kg IV, Q1-2 h.	Tachycardia, Increased blood pressure
Morphine Sulphate	0.1 mg/ kg IV- Q2 h.	Respiratory depression Nausea and vomiting
Diazepam (Valium)	0.1 mg/ kg IV Q1-2 h.	Venous thrombosis, phlebitis, respiratory arrest
Succinylcholine	1-2 mg/ kg IV	Bradycardia, contraindicated in patients. with hyperkalemia, neurological injury or following burns or trauma.

b) Ventilation:

If a patient is connected to a ventilator the patient should initially receive Positive End Expiratory Pressure (PEEP) of 5 to 6 cm H2O. This level is increased incrementally if the patient continuous to be hypoxic in a fractional concentration of inspired Oxygen (Fi O2) of 1.0. Should be affixed to the bag so that inspiratory pressure can be monitored. The Peak Inspiratory Pressure (PIP) is the amount of pressure needed to inflate the lungs and that is sufficient for alveolar ventilation. The following list provides initial ventilator settings:

i. Fractional concentration of inspired oxygen, 1.0.
ii. Respiratory rate, 20 to 40 bpm (depends on age and arterial carbon dioxide concentration).
iii. PEEP, 5 to 6 cm H2O.
iv. Peak Inspiratory Pressure 15-30 cm H20 to achieve a Tidal Volume of 5-8 ml/kg.
v. Inspiratory time, 0.5 to 0.8 second.
vi. You can assess adequate ventilation throughout transport by paying attention to the following clinical signs:
    - Adequate chest movements
    - Color: especially of the mucosa or conjunctiva.
    - Breath sounds: should be equal bilaterally (may be difficult to appreciate en route).
    - Bradycardia: this may indicate hypoxia.
    - Abdominal distention: It is advisable to insert a nasogastric tube in all intubated babies to remove any swallowed air.

c) Suctioning:

The ETT requires regular suctioning; the appropriate size of the suctioning catheter depends on the size of the endotracheal tube.

3.2 Putting ACCEPT into Practice

In this section we will demonstrate how the accept model can be applied in practice.

History:

A term male newborn, Salem, is referred from Sohar hospital to the Royal hospital. He was noted to be cyanosed from birth. He is a product of a normal delivery and was born without fetal distress. He is currently being managed in the intermediate zone of the SCBU, a local echocardiogram has shown that he has transposition of the great arteries (TGA). He needs to be transferred to the Royal hospital where a cardiac surgeon is available, the distance is approximately 200 Km away.

3.2.1 Assessment:

a) The problem

A more detailed history reveals that Salem is the third child of a 25-year-old woman who suffers from moderately severe asthma. His older brother has behavioral problems. Salem not in respiratory distress, breathing at a rate of 46/min and oxygen saturation 84% in room air. His heart rate is 130 beats/min and blood gas is normal. He is 6 hours old and the referring center has already started a prostaglandin E2 infusion through a peripheral percutaneous long line at 10 ng/kg/min. He has been stable on this for 2 hours. His chest radiograph is unremarkable. The local working diagnosis is TGA.

b) The sound bite:

The relevant information may be summarized quickly as shown in the box:

A 6 hour-old stable term Salem has a suspected diagnosis of TGA on prostaglandin E2 infusion at 10ng/kg/min. He is hemodynamically stable, not in distress, with oxygen saturation of 84% in room air. He needs to be transferred to the Royal Hospital for pediatric cardiac surgical evaluation and management.

c) What's being done?

This statement summarizes what has actually been done for the child. It should also prompt a structured approach (ABCDE) to what should be done.

- Airway: patent and stable
- Breathing: satisfactory
- Circulation: capillary refill time 2 seconds, heart rate (HR) 130/min, mean blood pressure (BP) 45 mmHg. Pre-ductal saturations 84% in room air
- Disability: alert and active
- Glucose: 6.4 mmol/L

d) In summary:

The baby is stable, alert and active. He is not on antibiotics and at this point no immediate resuscitation is required. A further arterial blood gas analysis, temperature and blood sugar assessment may be needed. It is possible that he may need ventilation because of the prostaglandin E2 infusion and the associated risk of apnea.

3.2.2 Control:

a) During assessment, the involved party include the team leader who is a pediatrician (either a consultant or a senior registrar), and a pediatric nurse from the SCBU trained in safe transportation.

b) The transport team needs to review the prostaglandin infusion because such infusions are uncommonly used so are prone to errors in preparation.

c) Equipment should be assembled, including spare medications and a transport ventilator.

3.3.3 Communication:

At this stage, all key individuals should be fully informed about the management of the child. In this instance, the following people would be involved:

a) Transport team members including a team leader

b) Referring and receving unit clinicians; consultant in charge of care.

c) Pediateric Cardiologist.

3.3.4 Evaluation:

The clinical need for transfer is not in doubt because the infant needs a pediatric cardiology assessment. It is appropriate that he is transferred by the neonatal team.

Category: urgent–stable

Mode: mode of transport needs to be considered – ground ambulance is appropriate here as distance between Sohar and Muscat is acceptable for ambulance transfer.

3.3.5 Preparation and packaging:

a) Preparation: this should follow the ABCDE format:

i) Airway and Breathing: There are no concerns about this baby's airway and breathing at present, but he is at risk of apnea, he needs to be assessed carefully when the team arrives. If there is any doubt or his infusion rate of prostaglandin needs to be increased, then intubation must be considered.

ii) Circulation: He does not require fluid resuscitation or other cardiovascular support at present. Prostaglandin should be treated like oxygen or inotropes and carried in excess on this transport.

iii) Disability and Environment: A newborn is at risk for hypothermia and should be transported in a transport incubator. A full debrief of the case must be provided to the medical and nursing staff. The team must be adequately dressed and prepared for transport (for example, take money).

b) Packaging:

i) All equipment and transport incubator/bed must be firmly secured in the ambulance and intravenous access as well as endotracheal tube must be well secured to the baby.

ii) The expected oxygen requirement should be calculated based on the expected duration of the transfer and then doubled.

iii) It is important not to forget the notes and radiographs, and cardiac echo images if possible.

3.3.6 Transfer:

a) Before taking off, the team leader should anticipate and know how to trouble shoot each potential complication that may occur during transfer.

b) Considerations of how to monitor en route and the requirements needed during transport as well as the transfer speed are all essential.

c) This is an urgent transfer and the child needs to be cared for in a tertiary center, but it is not time critical and the child is currently stable. Therefore, normal road speed limits should be observed.

d) Handover should be a joint exercise between nursing and medical staff and should follow the structured ACCEPT approach. All notes, radiographs and investigations should be handed over before returning transport equipment to the transfer center for cleaning.

A sample conversation between the transfer clinician (TC) and the receiving unit Doctor in the PICU may be as shown in the box.

PICU: Hello, Dr. Safia here (PICU Registrar) – how can I help?

TC: Hello Doctor, my name is Dr. Rashid. I am on the neonatal transfer team from Sohar Hospital; I would like to transfer a newborn boy from Sohar Hospital with suspected transposition of the great arteries to you for further assessment.

PICU: What is the baby's name?

TC: Baby Salem – he was born at term and is now 6 hours old. He is stable, breathing room air with oxygen saturations of 84%. He is on a prostaglandin E2 infusion at 10 ng/kg per min. He has had an Echocardiogram by the local team.

PICU: We do have a bed available at the moment. Can you tell me a bit more about him?

TC: Yes, certainly. His delivery was unremarkable and he didn't need resuscitation at birth. He weighs 3.8 kg. He was noted to be cyanosed shortly after delivery. As I said he is breathing spontaneously, his saturations are 84% and he is on a prostaglandin E2 infusion at 10 ng /kg per min via a long line. He is warm and well perfused, not tachycardic and normotensive. He has intravenous 10% dextrose running at 60 ml/kg per day and he otherwise appears well. His blood gases are normal.

PICU: Will he be transported mechanically ventilated?

TC: No, he is stable on prostaglandins for 2 hours now. We will reassess him when we get there and intubate him if needed. We will keep you informed.

PICU: What is your expected time of arrival?

TC: We can leave Sohar Hospital in 30 mins. We will probably be with you in about 2-3 hours time. Would that be all right?

PICU: Yes. I will let the cardiologist and the PICU consultant know – you can contact me on the direct line 24599716 Please ring us before you leave Sohar.

TC: No problem, I will get back to the consultant on call and let him know what we have agreed - I can be contacted via switch 26844579 on bleep 3134. I will also explain to the parents what's planned so far.

Managing Problems during Transfer

The key to managing problems during transfer is to anticipate potential complications; what can go wrong? How can we prevent it? How can we manage it if it does occur?
In the following section, we will explore potential complications during transfer and what actions need to be taken.

Be prepared, use the ABCDE approach:

1. Recognize problems promptly when they arise.
2. Ensure that equipment is readily available for anticipated problems.
3. Guide pre-planned action.

Table 4: Threats and actions during transfer with ABCDE approach

Threat	**Action to be taken**
Airway	
Outward migration of the ETT tube (dislodgement): The child may exhibit signs of a leak; gurgling sound on inspiration, crying or vocalization	• Stop the vehicle if possible, to assess. • Confirm displacement of the tube by checking ETT level at the lips, auscultate, look for respiratory distress or desaturation. • Use Co2 detector • Disconnect from mechanical ventilation. • Manually bag the child. • Exclude evidence of tube blockage. • Re-intubate in case of dislodgment of the tube and secure the tube.
Inward migration of ETT: Signs may be similar to above but desaturations may be more prominent and no vocalization/gurgling can be heard.	Confirm displacement with unequal chest movements, unequal breath sounds and direct visualization of the length of the ETT at the nose or mouth.

Occlusion or obstruction of ETT: Obstruction can occur as a result of secretions within the ETT. Dry secretions or blood can be a particular problem, especially if un-humidified air is used.	• Difficulty passing the suction catheter. • Visually check the tube for any visible kinks. Consider **pneumothorax** if ETT not displaced. • Reposition the ETT and secure it. • Use the suction device and an appropriate suction catheter and consider replacing the ETT if block not relieved.
Breathing	
Pneumothorax: Patients at risk include these with history of asthma, severe chronic lung disease, immune compromised with pneumocystis pneumonia, trauma or post chest surgical interventions.	Look for tachycardia, hypotension, desaturation, unequal chest expansion and air entry. Check if any existing chest drain is kinking or blocked. To relieve the pneumothorax, insert a large sized cannula connected to a 20ml syringe in the second intercostal space, mid-clavicular line on the suspected side. Aspirate until no longer possible. Do not remove the cannula till a proper chest drain is inserted. Aspirate intermittently.
Lung ventilation/perfusion mismatch: During the transfer process the blood flow is influenced by the acceleration/deceleration forces which may result in the child becoming hypoxic.	Recheck ventilator and monitors. Consider diversion to a nearby hospital. Pass a definitive chest drain. Increase oxygen supply during transfer.

Circulation	
Hypovolemia	Ensure that the child is appropriately fluid resuscitated before transfer. Continuous ECG monitoring looking for tachycardia. Overaggressive fluid resuscitation in the face of active bleed may actually increase blood loss.
Disability	
Failure of the delivery of sedation, analgesia or muscle relaxants	Check the integrity and potency of associated intravenous lines and the syringe drivers. Check if pump batteries need replacement.
Exposure and equipment	
Hypothermia	Check if the child is adequately monitored for temperature and covered.

Document History and Version Control

Document History and Version Control			
Version	**Description of Amendment**	**Author**	**Review Date**
01	Safe Transport for Clinically Ill Children – 1st Version. (ML- 92)	Department of Woman and Child Health	2017
02	Safe Transport for Clinically Ill Children – 2nd Version	Team for developing the SOP for the Safe Transportation of Clinically Ill Children	October 2024
03			
04			
05			
Written by	**Reviewed by**	**Approved by**	
Team for developing the SOP for the Safe Transportation of Clinically Ill Children	Dr. Jamila Al Abri Dr. Jumana Al -Abduwani	Dr. Said Al Lamki	

References:

1. *Guideline for the safe transportation of clinically ill children, first edition, 2013.*
2. *Policy & Procedures of Patient Transfer, Directorate general of specialized medical care, MoH.*
3. *Davis Al, Carcillo JA, Aneja RK et. American College of Critical Care Medicine Clinical Practice Parameters for Hemodynamic Support of Pediatric and Neonatal Septic Shock.Crit Care Med 2017;45(6):1061-1093.*
4. *Patregnani JT, Sochet AA, Klugman D et al.Short-Term Peripheral Vasoactive Infusions in Pediatrics:where is the Harm? Pediatr Crit Care Med 2017;18(8):e378-e381.*
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8. *Bonafide CP, Brady PW, Keren R et al. Development of heart rate and respiratory rate percentile curves for hospitalized children.Pediatrics.2013;131(4):e1150-7.*

ANNEXURE

Annex 1: Pre-transfer ABCDEF - Pediatric Transport Check List

Sultanate of Oman
Ministry of Health
Directorate General of Primary Health Care
Department of Woman and Child Health

Name: ……
Sex: …….. Weight: ……..
D.O.B: ……
I.D: ……

Medical Equipment and Consumables		Status		
		Qty	Yes	No
A) Basic Equipment	**1. Portable medication box and intravenous fluids**	1	☐	☐
	2. Stethoscope (pediatric)	1	☐	☐
B) Oxygen Accessories	**1. Portable oxygen equipment**			
	a) Portable oxygen cylinders minimum 300 litters capacity	2	☐	☐
	b) Oxygen regulator with fixed flow meter	1	☐	☐
	2. Oxygen administration equipment as applicable			
	a) Nasal cannula	2	☐	☐
	b) Non rebreathing mask	2	☐	☐
	c) Face mask	2	☐	☐
	d) Oxygen tubing (adequate length)	2	☐	☐
	e) Self-inflating Bag valve mask with oxygen reservoir f) (neonatal, pediatric) face mask sizes (0, 1, 2,3,4) as applicable	1	☐	☐
C) Cardiac monitoring	**a)** Cardiac monitor with full accessories (pediatric)	1	☐	☐
	b) ECG electrodes	1	☐	☐
D) Airway Equipment	**1. Airways**			
	a) oropharyngeal sizes 0 – 3 **Correct size measures from angle of mouth to angle of jaw*	1	☐	☐
	b) Laryngeal mask airway size 1 – 3 **LMA size based on weight* Size 1 (<5 kg) Size 1.5 (5-10 kg) Size 2 (10-20 kg) Size 2.5(20-30 kg) Size 3 (30-50 Kg)	1	☐	☐
	2. Intubation Kit			
	a) Laryngoscope handle	1	☐	☐
	b) Laryngoscope blades as applicable (curved and straight) c) Neonatal /Pediatric Blades: Straight Blades 0,1,2,3. d) Curved Blades: 1,2,3	1	☐	☐
	e) Endotracheal tubes cuffed and/or un-cuffed **Formula to calculate ET Tube size:* *Uncuffed tubes= Age/4 +4* *Cuffed Tubes = Age/4 +3.5*	2	☐	☐
	f) Stylet for ET tubes	1	☐	☐
	g) Magill forceps	1	☐	☐
	h) Lubricating gel	1	☐	☐
	3. Ventilation and Airway			
	a) Portable ventilator b) MRI Compatible Y/ N / /Not applicable c) Cylinder MRI compatible Y/N / Not applicable	1	☐ ☐ ☐	☐ ☐ ☐
E) Intravenous Lines Accessories	1. Intravenous lines/cannula sizes: 24,22,20,18 gauage 2. Intra-osseous Lines 3. Syringes : 2ml, 5ml, 10ml, 20ml **4.** d) tourniquet, 3 way stop cock, tegaderm, alcohol swabs,plaster, elastoplast	2	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
F) Medications	**1.** Adrenaline 1:10,000 and 1:1000		☐	☐
	2. Atropine sulphate		☐	☐
	3. Sedation : Ketamine, Fentanyl, and paralytic agents		☐	☐
	4. Inotropes		☐	☐

Checked by: …… ***Prior to departure:** ***Print resuscitation code sheet***

Annex 2: Pediatrics Patient Transfer Form (H/P-249):

Pediatric Transfer Form (To be filled by Referring medical staff).

Sultanate of Oman
Ministry of Health
Directorate General of Primary Health Care
Department of Woman and Child Health

Name: ……..
Sex: …….. Weight: ……..
D.O.B: ……Age: ……
I.D: ……..

Pediatric Patient Transfer Form

Admission Date:	Date Of Transfer and time:
Referring Institute:	Contact Details of Referring Doctor : Contact Number of Referring Doctor:
Receiving institute:	Contact Details of Receiving Doctor : Contact Number of Receiving Doctor:
Type of Referral : ☐ Elective ☐ Urgent ☐ Emergency	
Mode of Transfer ☐ Land ☐ Air ☐ Sea	
Referral Reason ☐ Need for Specialized Care ☐ Evaluation/Procedures ☐ Surgical ☐ Lack of Beds	
Clinical Diagnosis Clinical Details	
Past Medical History Past Surgical History (if applicable)	
Code Status ☐ Full Code ☐ DNR (Human Care)	
Isolation Precautions: ☐ Yes ☐ No Type: ☐ Droplet ☐ Contact ☐ Airborne	Organism: ☐ MRSA ☐ VRE ☐ ESBL ☐ C. Diff ☐ Others: …… ……
Respiratory Needs ☐ None ☐ Oxygen ☐ NIV ☐ Ventilated ☐ Tracheostomy	
If Ventilated: ETT Size..... Cuffed?..... Length from Lips:..... Position Verified with CXR?..... Difficult Intubation ☐ Yes ☐ No Settings: PIP..... PEEP ..... Rate ..... Fio2..... Tidal Volume ..... Last Blood Gas: PH ..... PCO_3 .....HCO_3 .....BE.....SPO_2 .....Lactate ……	
Hemodynamic state: BP:……..…….. Heart rate:…… Capillary refill time: …… Inotropes(if any …… …….……..	
Presence of Neurological Disability : ☐ Yes ☐ No	If Yes, specify Glasgow Coma Scale E..... V..... .M..... Pain score as applicable: .....
Intravenous Lines ☐ Peripheral Lines ☐ Central Line Number …… Fluid Type…… Rate…… Site ……..	
Lab Tests: Blood Sugar..... Urea …… Creatinine …… K…… Na…… Mg…….. Others (specify): ……	
Medications: …… ……..	☐ Foley's catheter ☐ Chest drain ☐ NGT ☐ Pacemaker

Enroute Monitoring (to be filled by Transfer team / Attach Medication, Ventilator Chart as applicable													
Time of Departure													**Arrival**
Heart Rate													
Blood Pressure													
Respiratory rate													
Saturation													
Temperature													
GCS													

Medical advice :

1.Airway/Breathing/ Ventilation

……

2.Hemodynmic and blood pressure:

……

3. Frequency of neuro .observation and management:

……

4. Fluid plan:

……

5. Antibiotics and medications:

……

6.Others:

……

**The advice plan should be filled as applicable to child's acuity*

***Consultants in Both referring and receiving units should be aware of the transfer plan*

Outcome of Transfer (*to be filled by the receiving team*)

Outcome	**Complication**	
☐ Uneventful ☐ Complications	❑ Need For CPR on arrival ❑ Significant desaturation < 90% on arrival ❑ Need for intubation on arrival	❑ Non Functioning Lines on arrival ❑ Failure Of equipment ❑ Others, specify……

Additional Remarks:

Name of Escorting Doctor: Signature	Name of Receiving Doctor: Signature:
Name of Escorting Nurse: Signature:	Name of Receiving Nurse: Signature:

Annex 3: Guideline for Filling up Pediatrics Patient Transfer Form (H/P-249)

Introduction:

Pediatrics Patient Transfer Form (H/P-249) is unified for every transferred case from one health care level to another, and it is made to further strengthen the documentation of patient's details, and facilitate extraction of the needed data.

Objective:

- To ensure proper documentation of patient's information before, during and after transfer.
- To have a national data base for the pediatric transfers, reasons, and outcomes of transfer.

When to fill the form?

- The form should be filled up for every case needing transfer from one level to another.
- The form should be filled by the accompanying health physician, if not available the nurse.
- The form should be taken along with the patient during the transfer process to document events occurring during the transfer process.
- Escorting team should make sure to submit the filled part for the escorting team and receiving team should make sure to fill the corresponding part.
- Documentation is shared between receiving and referring hospitals. The Leader of the transfer team is responsible to make sure of filling up the Pediatrics Patient Transfer Form (H/P-249).
- Both health care professionals (transferring and receiving) should sign the form.

Who should fill the form?

Any physician who is involved in transferring the child should fill up the form. In most situations the pediatrician or general physician (if not available then the nurse involved in transferring the child).

Annex 4: Vital Signs

Heart rates percentiles for the different age groups

Age group	*1st*	*5th*	*10th*	*50th*	*90th*	*95th*	*99th*
0 - 3 months	*103*	*113*	*119*	*140*	*164*	*171*	*186*
3 < 6 months	*98*	*108*	*114*	*135*	*159*	*167*	*182*
6-< 9 months	*94*	*104*	*110*	*131*	*156*	*163*	*178*
9-< 12 months	*91*	*101*	*107*	*128*	*153*	*160*	*176*
12-< 18 months	*87*	*97*	*103*	*124*	*149*	*157*	*173*
18-< 24 months	*82*	*92*	*98*	*120*	*146*	*154*	*170*
2-<3 years	*77*	*87*	*93*	*115*	*142*	*150*	*167*
3-<4 years	*71*	*82*	*88*	*111*	*138*	*146*	*164*
4-<6 years	*66*	*77*	*83*	*106*	*134*	*142*	*161*
6-<8 years	*61*	*71*	*77*	*100*	*128*	*137*	*155*
8-<12 years	*56*	*66*	*72*	*94*	*120*	*129*	*147*
12-<15 years	*51*	*61*	*66*	*87*	*112*	*121*	*138*
15-<18 years	*48*	*57*	*62*	*82*	*107*	*115*	*132*

Source: Bonafide CP, Brady PW, Keren R et al. Development of heart rate and respiratory rate percentile curves for hospitalized children Pediatrics.2013;131(4):e1150-7.

Annex 4 (contd.): Vital Signs

Respiratory rate percentiles for the different age groups

Age group	*1st*	*5th*	*10th*	*50th*	*90th*	*95th*	*99th*
0 <3 months	*22*	*27*	*30*	*41*	*56*	*62*	*76*
3-<6 months	*21*	*25*	*28*	*38*	*52*	*58*	*71*
6-<9 months	*20*	*23*	*26*	*35*	*49*	*54*	*67*
9-<12 months	*19*	*22*	*24*	*33*	*46*	*51*	*63*
12-<18 months	*18*	*21*	*23*	*31*	*43*	*48*	*60*
18-<24 months	*16*	*20*	*21*	*29*	*40*	*45*	*57*
2-<3 years	*16*	*18*	*20*	*27*	*37*	*42*	*54*
3-<4 years	*15*	*18*	*19*	*25*	*35*	*40*	*52*
4-<6 years	*14*	*17*	*18*	*24*	*33*	*37*	*50*
6-<8 years	*13*	*16*	*17*	*23*	*31*	*35*	*46*
8-<12 years	*13*	*15*	*16*	*21*	*28*	*31*	*41*
12-<15 years	*11*	*13*	*15*	*19*	*25*	*28*	*35*
15-<18 years	*11*	*13*	*14*	*18*	*23*	*26*	*32*

Source: Bonafide CP, Brady PW, Keren R et al. Development of heart rate and respiratory rate percentile curves for hospitalized children. Pediatrics. 2013; 131(4):e1150-7

Annex 4 (contd.): Vital Signs

Blood Pressure Ranges for Infants and Children

Age	*Systolic Blood Pressure (Female)*	*Systolic Blood pressure (Male)*	*Diastolic Blood pressure (Female)*	*Diastolic Blood Pressure (Male)*
Neonate	*60-76*	*60-74*	*31-45*	*30-44*
1 month	*73-91*	*74-94*	*36-56*	*37-55*
3 months	*78-100*	*81-103*	*44-64*	*45-65*
6 months	*82-102*	*87-105*	*46-66*	*48-68*
1 year	*86-104*	*85-103*	*40-58*	*37-56*
2 years	*88-105*	*88-106*	*45-63*	*42-61*
7 years	*96-113*	*97-115*	*57-75*	*57-76*
15 years	*110-127*	*113-131*	*65-83*	*64-83*

Note: Readings are the range from 1 SD below and 1 SD above the mean for those during the 1st one year of life and from 50th – 95th centile for children > 1 year.

Annex 4 (contd.): Vital Signs

Defining Hypotension for Age Based on Blood Pressure Values

Age	*Systolic Blood Pressure (mmHg)*
Term Neonates (0-28 days)	*< 60*
Infants (1 to 12 months)	*< 70*
Children 1- 10 Years (5^{th} blood pressure Percentile)	*< 70+(age in Years x 2)*
Children > 10 Years	*< 90*

Note: These Blood Thresholds approximate just above the 5th Percentile systolic Blood Pressures for age. An observed decrease in systolic Blood Pressure of 10 mmHg from baseline should prompt serial evaluations for additional signs of shock.

Annex 5: A Summary of the Transport Process:

Stage of Transport Process	***What else would you like to know?***	***Remarks***
Assessment	***Identify key issues*** *1. What is wrong?* *2. What do you need?*	
	Attempt structural approach to assessment	
	Consider most appropriate placement of patient	
Control	***What action would you undertake?***	
	1. Identify transport team and leader	
	2. Identify tasks, equipment/staff	
	3. Identify tasks – pre-transport advice	
	4. Identify tasks – liaise with units/ambulance	
	5. Ensure tasks allocated and documented	
Communication	***To whom and how would you communicate?***	
	1. Considers structure of communication	
	2. Consider content of communication ➢ *Who are you?* ➢ *What is needed from the listener?* ➢ *What are the patient's basic details?* ➢ *What is the problem?* ➢ *What has been done?* ➢ *What was the response?* ➢ *What is needed?*	
	3. Have the key parties been communicated with?	
Evaluation	***What further decisions are now required?***	
	1. Establishes urgency of transfer	
	2. Establishes appropriateness of transfer	

	3. Considers mode of transfer	
Preparation and packing	***What would you do before transferring the patient?***	
	1. Actions on arrival	
	2. Undertakes handover	
	3. Optimize patient's condition – ABC, etc.	
	4. Communication with family	
	5. Secures equipment to patient	
	6. Prepares trolley, incubator and ambulance	
	7. Packages patient	
	8. Pre-departure checks	
Transportation	***What are important aspects for the return journey?***	
	1. Ensure equipment is securely loaded	
	2. Monitoring and documentation	
	3. Appropriate road speed	
	4. Logical approach to troubleshooting	
	5. Appropriate handover	

Annex 6: Common Resuscitation Medications

- *Adrenaline:*
  - *Cardiac arrest Dose: 1:10,000 at 0.1 ml/kg/dose (I/V, I/O)*

    1:10000. 1 mg/kg if given by ETT
  - *Croup: 0.5 ml/kg of 1:1000 by inhalation.*

- *Lignocaine: 1 mg/kg.*
- *Morphine: 0.1 mg/kg/dose.*
- *Midazolam: 0.1mg/kg/dose.*
- *Pancuronium (Pavlon): 0.1mg/kg/dose*
- *Rocuronium 1 mg/kg/dose*
- *Salbutamol neb: 2.5-5 mg/ dose.*
- *Atrovent: 125-250 mcg /dose.*
- *Atropine: 0.02 mg/kg per dose*
- *Dextrose 10%: 5-10 ml/kg*
- *Dextrose 25%: 2-4 ml/kg*
- *Dextrose 50%: 1-2 ml/kg*

Annex 7: Common inotropes used, Doses and administration

All inotropes should be titrated to achieve normal blood pressure for age and reversal of shock i.e., improved heart rate, blood pressure, perfusion, urine output and mental state.

a) Adrenaline (Epinephrine)

Mechanism of action: At smaller doses < 0.1 mcg/kg/min, it has greater Beta2 adrenergic effects on the peripheral vasculature leading to fall in SVR. At higher doses, it has more alpha and beta 1 effects leadings to increase in heart rate, increase in SVR and increase in contractility.

Dose range: 0.05- 0.25 mcg/kg/min

Route: central access is recommended but if unavailable, peripheral access can be used with care to prevent extravasation.

* Peripheral access use should be diluted 10 times as compared to central use.
* It is advised to check how to do the preparation with the receiving unit/consultant

b) Dopamine

Mechanism of action: Pharmacological effects on Beta1 receptors at doses up to 10 mcg/Kg/min. At higher doses, there are effects on alpha receptors increasing SVR leading to cold extremities.

Dopamine can be used in cold shock.

Dose range: Starting dose of 5-10 mcg/kg/min. Infusion Rate > 15 mcg/kg/min is associated with increase in vasoconstrictor effects and increase heart rate (chronotropic effects).

Route: Central access is recommended but if unavailable, peripheral access can be used.

c) Dobutamine

Mechanism of action:

Has effects on Beta2 receptors leading to afterload reduction (reduction in SVR). In addition, it has effects on alpha and beta1 receptors leading to increase in contractility.

Dose range: 5-10 mcg/kg/min, the infusion can be increased to 15-20 mcg/kg/min.

Route: Central access is recommended but if unavailable, peripheral access can be used.

d) Milrinone

Mechanism of action:

This is non-catecholamine inotrope. It works by inhibiting phosphodiesterase III leading to increase cAMP. Milrinone has vasodilatory and lusitropic effects. In case of excessive effect, SVR and systemic blood pressure will decrease. This should be treated with administration of a fluid bolus of 5ml/kg and titrating down milrinone. Milrinone has a long half-life (1-10 hours) which increases in children with renal failure.

Dose range: 0.25-0.75 mcg/kg/min

Route: Central access is recommended but if unavailable, peripheral access can be used.

e) Noradrenaline:

Mechanism of action:

Has potent effects on alpha and beta receptors leading to vasoconstriction and increase in SVR.

Dose range: 0.05-0.25 Mmcg/kg/min

Route: Central access is recommended but if unavailable, peripheral access can be used.

* Peripheral access use should be diluted 10 times as compared to central use.

* It is advised to check how to do the preparation with the receiving unit/consultant

Annex 8: Additional Information

Blood pressure cuffs	The width of the cuff should be more than 80% of length of upper arm/leg and the bladder more than 40% of the arm's circumference
Peripheral intravenous catheters	All sizes should be available: 14 G (brown) 16 G (grey); 18 G (green); 20 G (pink); 22 G (blue); 24 G (yellow); 26 G (white). Always site largest possible for transfer
Intraosseous access	Site/s: Anterior (medial) surface of tibia (ensure can access easily) 2–3 cm below tibial tuberosity Other sites: Distal tibia Above medial malleolus
Central venous catheters	4, 5 and 7 Fr, 5–20 cm, two to three lumens. Appropriate size and length to be specified by experienced operator
Urinary catheter	Neonate: Nasogastric tube 5 Fr/6 Fr Infant: 6–8 Fr Foley with balloon 1–12 years: 8-12 Fr Foley with balloon