
Guidelines for the safe transport of clinically

III Children

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Acknowledgement

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Abbreviations:

ABC	Airway Breathing Circulation
BP	Blood pressure
CBC	Complete blood count
ETT	Endo tracheal tube
Kg	Kilograms
IV	Intra venous
Lpm	Liters per minute
Mg	Milligrams
ml	Millilitre
mm	Millimetre
NRP	Neonatal Resuscitation Program
NPO	Nothing per os = nothing by mouth
NG	Naso-gastric
PALS	Pediatrics Advanced Life Support
PICU	Pediatrics Intensive Care Unit
PRO	Public Relationships Officer
TGA	Transposition of the Great Arteries

Preface

Transferring patients from one hospital to another is an integral part of any medical delivery system. Recent evidence indicates that adverse effects are possible 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 MoH and training of health care professionals was initiated in 2011, which was done in conjunction with NETS- UK. These guidelines are produced to ensure the following:

1. Streamlining the process of safely transporting critically ill children from one hospital to another.
2. Reduction in morbidity and mortality related to transporting critically ill children.
3. Provision of data related to inter- hospitals transfers in Oman and their outcomes.

These guidelines are divided into 4 sections; section one: describes the organization of the transport process in the hospital, team, trainings, equipments and documentations.

Section two: describes using a structured approach model (ACCEPT) to transfer. This is to ensure no part is being missed and all steps are followed.

Section three: provides a practical approach for using the model.

Section four: describes common threats that could occur during the transfer process and what actions to be taken to rectify them.

Guidelines for the safe transportation of clinically III Children

AIM: These guidelines aim to ensure safe and timely transport of neonates and children requiring emergency or controlled transfer from one level of healthcare to another.

To ensure the appropriateness of the process, each health facility must have the following in place:

1. **A dedicated transport team.**
2. **Trained personnel on Advanced life support according (NRP, PALS or ACLS).**
3. **Trained personnel on the safe transport of critically ill children.**
4. **Management information system (MIS).**
5. **Suitable and functional transport equipment.**

1.1. Who is involved in the transport process?

- It is recommended that for every Secondary level health facility to have a core group to perform the transport. This group constitutes of individuals that are competent in Pediatrics Advanced Life Support (PALS)/ Neonatal Resuscitation Program (NRP) and completed the safe transport and retrieval course. It is recommended to involve the biomedical engineer in the core group of transport.
 - The Head of Pediatrics at each hospital should lead the core group in order to ensure the proper organization of the transport process, supervision of training of team members, availability of equipment, organizing transport duty rotations and other related logistics.
 - For urgent cases a minimum of 2 people should accompany the patient. A doctor and a nurse competent in advanced life support skills should accompany a critically ill or intubated child , the specific roles of the physician and nurse are outlined in (Table 1).
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Role of the transporting physician	Role of the transporting nurse
<p>Team leader of the team. The responsibilities of the team leader are:</p> <ul style="list-style-type: none"> • Overall control of the transfer process. • Communication with the receiving center and receiving approval for transfer from consultant in charge. • Informing parents about the transfer and explaining to them associated risks and benefits. • Taking charge of the clinical care of the child and ensuring continuity of critical care. • Filling necessary documents. • The physician should also be well trained in obtaining and securing a patent airway, placing arterial lines, and obtaining vascular access, including obtaining Intraosseous access. • Prescribe/ administer necessary medication during transfer. 	<ul style="list-style-type: none"> • Should be skilled in the nursing care of the critically ill child and is adept at monitoring pediatric patients, administering various drugs, maintaining temperature control and providing general nursing care. • Ensure all equipment is available and in a usable condition before and during the transport. • Ensure all transport drugs are available and in a usable condition before and during the transport. • The nurse should be familiar with all the forms required and ensure that they are filled appropriately before, during and after the transfer process.

Table (1): specific roles and responsibilities

1.2. What transport Equipment is needed?

- Equipment is divided into three categories: respiratory equipment, monitoring equipment and transport medications (annex 2).
- It is the responsibility of the nurse in charge of the A&E in each shift to make sure that equipment is available in place and functional.

1. 3. Documentation and recording:

All relevant information of the child's condition must be documented in the appropriate forms (ANNEX 6).

Section
2

Using a structured approach to transfers

These guidelines aim 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

2.1. Assessment:

This first step is carried out prior to transporting a patient. Sometimes the clinician involved in the transportation has been involved in the care of the patient. However many times he/she has not and a transporting doctor would be brought specifically for that purpose. Proper assessment requires taking into consideration both the child's clinical condition as well as the competencies of the transferring team. (Answering the following questions may aid the process):

<p>Assessment Questions:</p> <ul style="list-style-type: none">• 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 4 for a summary).

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 ET 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 become snared or drag the ET 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?

Breathing:

- Is sufficient oxygen available for the transfer?
- Is a self-inflating bag–valve–mask system 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?

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)?

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.

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?

2.2. Control:

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

2.2.1. Task identification:

Once control has been established, clinical care of the child must continue, communication with those who need to know then becomes a priority. Resources including staffing, equipment and drugs will need to be identified and allocated. In summary:

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

2.2.2. Task allocation:

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

2.3. 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.

2.3.1. Involved personnel:

From the referring hospital:

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

To the receiving team:

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

2.3.2. 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:

- Who are you? (Name and designation).
- What is needed? (From the listener).
- Relevant details of the child.
- What the problem is? (Primary and secondary diagnosis).
- Summary of main laboratory investigations, radiological investigations and other relevant clinical details.
- Main interventions/ procedures carried out at the referring hospital.
- 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.

2.3.3. Communication with parents:

- Transferring a sick child can be a stressful event for parents and families. In many times a situation has progressed from that of having a normal, healthy child, or expecting a healthy baby to one of having a critically ill child that needs to be transferred to a specialized center and receive intensive care. This may induce a range of different emotions; stress, anxiety, anger and fear of the uncertain. It is essential for the medical and nursing staff to show compassion and understanding.

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. Communication should be clear, precise and open. Speculation and unrealistic assurances should be avoided.

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

- Most of the times parents do not object to transferring the child. However, it is possible that in certain cases the parents might refuse the transfer. In this case, the consultant on call should counsel the parents. If parents still disagree it may be necessary to involve the hospital administration and the Public Relationship Officer (PRO) in order to ensure that the patient receives the necessary care.

2.4. 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:

Emergency (critical time):

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

- **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.

Urgent:

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

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

- **Elective:** Transfer of a stable patient for a second opinion or further investigations.

Category of clinical incident		Urgency	Driving mode	Personal
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

2.5. Preparation & 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:

2.5.1. Preparation: there are three distinct components to this step; 1. The child must be stabilized to reduce any physiological complications 2. All necessary equipment must found and checked 3. All personnel who are to undertake the transfer must be prepared.

2.5.1. 1. 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 about the child's needs. 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 then elective intubation should be considered. 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: $\text{age}/4+4$ and the formula to calculate the ETT length is: $\text{age}/2 + 12$ cm (oral), $\text{age}/2 + 15$ cm (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 the child has good IV access prior to transport. It is advisable that a child has either two peripheral access points or one sutured central access. 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.

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.

- ✓ Children may also become hypothermic during transfer. Ensure appropriate measures are taken to prevent hypothermia.

2.5.1.2. 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.
- ✓ Make sure you carry all documents, films, investigations and transfer forms with you.
- ✓ It may be useful to keep a loading check list and use multi-compartment bags.

2.5.1.3. 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.

2.5.2. 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.

2.5.2.1. Packaging the child:

The key elements in packaging the child are security and accessibility.

- ✓ Any endotracheal tube (ETT) must be securely fastened. 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, for example during air transport, the cuff on the cuffed tubes should be filled with water rather than air. This avoids the associated volume changes that may damage the trachea.**
 - ✓ 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).
 - ✓ A reserved oxygen supply must be readily on 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 inside 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 drug and fluids administration. All the intravenous lines must be secured before transfer. Peripheral lines should be fixed in place with adhesive dressings. 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 stitched in place after insertion. The insertion site should be covered with transparent, adhesive dressing. The access port can be secured to the shoulder of the child to avoid displacement during transfer.
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- ✓ 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.

2.6. Transportation:

All critically ill patients should receive the same level of physiological monitoring available in the Intensive Care Unit (ICU) this includes at a minimum continuous ECG, continuous 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 appropriate and fits.
- ✓ 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 check adequate ventilation and oxygenation are achieved; if possible check the blood gas after 10 minutes.
- ✓ Ensure adequate ventilation on both sides of the chest.
- ✓ 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.
- ✓ Where 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 aid.

The measures below should be considered in the transportation process:

Sedation and pain management:

It is easier to maintain the patient's ventilation during transport if the patient is kept sedated and paralyzed. This precaution minimizes the chance that the endotracheal tube will become displaced.

The following medications can be used for the purposes of sedation, paralysis and pain management:

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- 2 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.

Table 1: Sedation, paralysis and pain management to be used during transfer.

Ventilation:

- If a patient is connected to a ventilator the patient should initially receive Positive End Expiratory Pressure (PEEP) of 4 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 is the amount of pressure needed to inflate the lungs and that is sufficient for alveolar ventilation. The following list provides initial ventilator settings:

1. Fractional concentration of inspired oxygen, 1.0.
2. Respiratory rate, 20 to 40 bpm (depends on age and arterial carbon dioxide concentration).
3. PEEP, 4 to 6 cm H₂O.
4. Peak Inspiratory Pressure 15-30 cm H₂O to achieve a Tidal Volume of 6-10 cc/kg.
5. Inspiratory time, 0.5 to 1.0 second.

- 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.

Bradycardia: this may indicate hypoxia.

Abdominal distention: It is advisable to insert a nasogastric tube in all intubated babies to remove any swallowed air.

Suctioning:

The ETT requires regular suctioning; the appropriate size of the suctioning catheter depends on the size of the endotracheal tube: the smaller the tube the smaller the suction catheter should be.

Section 3

Putting ACCEPT into practice

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

History:

Male newborn Salem is referred from Sohar hospital to the Royal hospital. He is a term baby and has been cyanosed from birth. He was 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.

Assessment: - The problem:

A more detailed history reveals that baby Salem is the third child of a 25-year-old woman who suffers from moderately severe asthma. His older brother has behavioral problems. Baby Salem is breathing in room air with oxygen saturations of 84%. He has no respiratory distress. His heart rate is 130 beats/min and his pH and pCO₂ are within normal ranges. He is 6 hours old and the referring centre 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.

The sound bite:

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

A 6-hours old stable term Salem, with suspected TGA. He is breathing air with oxygen saturations of 84% and is on prostaglandin E₂ infusion at 10 ng/kg/min and needs

transfer to the Royal Hospital for a pediatric cardiac surgical evaluation and management.

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 is 2 seconds, heart rate (HR) 130, mean blood pressure (BP) is 45 mmHg. Pre-ductal saturations are 84% in room air

Disability: alert and active.

Glucose: 6.4 mmol/l

In summary: 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

Control:

During the assessment stage, the following staffs are likely to be involved: a pediatrician (either a consultant or a senior registrar) who should act as a team leader and a pediatric nurse from the SCBU trained in safe transportation.

Tasks:

1. The baby is stable, so the next clinical question is to consider the need for intubation with a low rate of prostaglandin E2 infusion?

The infant has been stable on the rate of infusion for 2 hours it is reasonable to transport the infant unventilated. This will need further assessment on arrival of the team. The ability to safely ventilate this infant on the transfer is essential.

2. The transport team needs to review the prostaglandin infusion because such infusions are commonly miscalculated as a result of lack of familiarity with an infrequently used medication and concentration. There is also often confusion regarding different prostaglandin preparations and the wrong one may be in use.

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

Communication:

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

- Transport team members including lead clinician
- Referring and receiving unit clinicians; consultant in charge of care
- Pediatric Cardiologist.

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 – ambulance is appropriate here as distance between Sohar and Muscat is acceptable for ambulance transfer.

Preparation and packaging:

Preparation: this should follow the ABCDE format:

- **Airway and Breathing:** there are no concerns about this baby's airway and breathing at present but he is at risk of apnoea, 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 reconsidered.

• **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.

• **Disability and Environment:** although this is a term infant with a good birth weight, he is still very susceptible to cold stress and should therefore be transported in a transport incubator. Other elements to preparation include the medical and nursing staff, who need to be informed of all the clinical details. The team must be adequately dressed and prepared (for example, take money).

Packaging:

- The baby will need to be in a transport incubator or a trolley that can be firmly secured to the ambulance. All equipment needs to be firmly fixed.
- The expected oxygen requirement should be calculated based on the expected duration of the transfer and then doubled.
- All equipment should be secured to the trolley and all drips and lines must be secured to the baby.
- It is important not to forget the notes and radiographs, and cardiac echo images if possible.

Transfer:

- Before setting off on a transfer the team leader should consider what could go wrong during this transfer.
- They should think about how to observe the child and the electronic monitoring that will be required during transport. Transfer speed should be considered.
- This is an urgent transfer and the child needs to be cared for in a tertiary centre, but it is not time critical and the child is currently stable. Therefore normal road speed limits should be observed.
- 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 centre 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 has intravenous 10% dextrose running at 60 ml/kg per day and he otherwise appears well. His blood gases are fine.

PICU: Is he going to be coming over ventilated?

TC: No, he is stable at the moment and he has been on prostaglandin for a couple of hours now. We will reassess him when we get there but hopefully we can bring him over extubated – if we are at all concerned we will intubate him. If we do I will ring to let you know.

PICU: Well that all sounds OK. What time do you think you might get to us?

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 that's fine. 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.

Obviously a great deal more information could be shared here, but the essential information has been exchanged, the bed negotiated, contact details exchanged and agreement made about who will communicate with whom.

Section
4

Threats and Actions during transfer

Section three: Threats and Actions during transfer

The key to managing problems during transfers is having preemptive thinking; what can go wrong and how can we identify the problem if prevention failed? In the following section we will explore common threats that can happen during transfer and what actions need to be taken.

Be prepared, be pessimistic – *'what can go wrong... will go wrong'*

Use an ABCDE approach :

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

ABCDE approach:

Threat	Action to be taken
Airway	
<p>Outward migration of the ET tube dislodgement: the child may exhibit signs of a leak; gurgling sound on inspiration, crying or vocalisation.</p>	<p>Stop the vehicle if possible and assess the child.</p> <p>Confirm displacement of the tube by checking that the level of the tube at the lips or nose has changed.</p> <p>Manually ventilate the child.</p> <p>Re-position the ET tube or</p> <p>Re-intubate and secure the tube.</p> <p>Arrange for the vehicle to stop.</p>

<p>Inward migration of ET Tube: although the child may show similar signs as above but the first indication may be a drop in pulse oximetry as a result of ventilation reaching one lung on</p> <p>Occlusion or obstruction of ET Tube: obstruction can occur as a result of secretions within the ETT. Dry secretions can be a particular problem, especially when dried gasses are used to ventilate the child.</p>	<p>Disconnect from mechanical ventilation. Exclude evidence of tube blockage. Confirm displacement by clinical signs; such as equal chest movements bilaterally, equal breath sounds over both sides of the chest and direct visualization of the length of the ETT at the nose or mouth.</p> <p>Suction the tube, if you find difficulty passing the suction catheter it may be blocked.</p> <p>Think Pneumothorax if the tube is patent and correctly placed.</p> <p style="padding-left: 40px;">Reposition the ET tube and secure it.</p> <p>Visually check the tube for any visible kinks. Use the suction device and an appropriate suction catheter to clear suction from the ET Tube lumen. Consider replacing the ET Tube completely.</p>
Breathing	
<p>Pneumothorax: children with a history of asthma, severe chronic lung disease, immunocompromised children with pneumocystis chest infections, any type of traumatic physical injury, child with a medical intervention such as thoracic surgery are at increased risk.</p> <p>Lung ventilation and perfusion mismatch: during the transfer process the blood flow is influenced by the acceleration/deceleration forces which may result in the child becoming</p>	<p>Always keep a high index of suspicion in children with risk factors. If suspected look for changes in oxygenation, blood pressure or a symmetrical chest movements. Check if any existing chest drain is not kinking. To relieve the pneumothorax insert a large cannula in the second intercostals space in the mid-clavicular line on the suspected side. Do not remove the cannula till a proper chest drain is inserted. Recheck ventilator and monitors. Consider diversion to nearby hospital. Pass a definitive chest drain. Increase oxygen supply during transfer.</p>

hypoxic.	
Circulation	
Hypovolemia	<p>Ensure that the child is appropriately fluid resuscitated before transfer.</p> <p>Monitor the child's ECG carefully for changes in heart rate or rhythms as tachycardia and dysrhythmias may indicate hypovolemia.</p> <p>Overaggressive fluid resuscitation in the face of active bleed may actually increase blood loss</p>
Disability	
Failure of the delivery of sedation, analgesia or muscle relaxants	<p>Check the integrity and potency of associated intravenous lines and the syringe drivers.</p> <p>Check if batteries need replacement.</p>
Exposure and equipments	
Hypothermia	<p>Check if the child is adequately covered. Is the monitoring and therapeutic equipment adequately secured.</p>

Table 2: threats and actions during transfer

ANNEX 1: TRANSPORT EQUIPMENT

1.2.1. Respiratory equipment:

- 50 psi oxygen source
- Oxygen flow meter with 15 lpm capacity
- Oxygen devices (nasal cannula, ordinary and non re-breathing masks for spontaneous ventilation)
- Neonatal/ pediatric transport ventilator (for secondary and tertiary hospital)
- Self inflating bags (Ambu bags). 250ml for small babies, 500ml and 1500mls.
- Face masks for artificial ventilation of different sizes (small, medium and large).
- Laryngoscopes straight bladed sizes 0, 1, 2, and curved sizes 1,2,3,4.
- Endotracheal uncuffed tubes sizes 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0 and 6.5
- Endotracheal tubes stylets
- Magill forceps, neonates/ pediatric
- Oral airways sizes 00,0,1,2,3
- Suction apparatus with battery backup
- Suction catheters (size 6,8,10 and 12 FG)
- Yankauer suction
- Bulb syringe for suction
- Nasogastric tubes (size 6,8,10 and 12 FG)
- Aerosol medication delivery system

1.2.2. Monitoring equipment:

- Stethoscope
- Cardio- respiratory monitor (ECG, Oxygen saturation, RR, BP)

- ECG electrodes (infants and child)
- Pulse oximeter
- Blood pressure (BP) measurement apparatus (manual and automatic)
- BP cuffs (neonatal, infant and child)
- Thermometer
- Flashlights
- Defibrillator with pediatric paddles (preferred)
- Communication backup, mobile phone (optional)
- Transport isolette/incubator for neonates (preferred).
- Spare batteries
- ET CO2 detector.

1.2.3. **Miscellaneous :**

- Adhesive tapes
- Urinary bladder catheters
- Intravenous cannulas 24,22,18 and 16 guages
- Tourniquets for venopuncture and IV access
- Arm boards
- Intraosseous cannulas
- Chest drain tubes.
- Syringes 1ml, 3ml, 5ml,10ml,20ml and 50 ml
- Assorted size needles
- Infusion pumps, simple, easy to use with long lasting battery
- Normal saline 10ml ampoules/ water for injections.
- Intravenous fluid administration tubing
- Three- way stopcocks

ANNEX 2: TRANSPORT DRUGS:

- Dopamine: if the child is hypotensive despite intravenous fluid boluses start with 5mcg/kg/min and increase as needed up to 20mcg/kg/min.
- Adrenaline: 1:10,000 at 0.1 ml/kg/dose I/V, I/O. 1 mg/kg if given by ETT
1:1000 at 0.5 ml/kg in croup by inhalation.
- Lignocaine: 1 mg/kg.
- Morphine: 0.1 mg/kg/dose.
- Midazolam: 0.15mg/kg/dose.
- Pancuronium (Pavlon): 0.1mg/kg/dose
- Salbutamol neb: 2.5-5 mg/ dose.
- Atrovent: 125-250 mcg/kg/dose.
- Atropine: 0.02 mg/kg per dose (minimum single dose of 0.1 mg).
- Dextrose: 5%, 10% and 25% ml/kg.
- 0.9% saline 500ml.

ANNEX 3: A SUMMARY OF THE TRANSPORT PROCESS:

Assessment	<i>What else would you like to know?</i>	Remarks
	Identify key issues: - What is wrong? - What do you need?	
	Attempt structural approach to assessment.	
	Consider most appropriate placement of patient.	
CONTROL	<i>What action would you undertake?</i>	
	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	<i>To whom and how would you communicate?</i>	
	1. Considers structure of communication	

		<p>2. Consider content of communication: - - Who you are</p> <ul style="list-style-type: none"> - What is needed – from the listener - What the patient’s basic details are - What the problem is - What has been done - What the response was - What is needed 	
		3. Are key parties communicated with?	
EVALUATION		<i>What further decisions are now required</i>	
		1. Establishes urgency of transfer	
		2. Establishes appropriateness of transfer	
		3. Considers mode of transfer	
PREPARATION & PACKAGING		<i>What would you do before transferring the patient?</i>	
		1. Actions on arrival	
		2. Undertakes handover	
		3. Optimise 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		<i>What are the important aspects</i>	

	<i>for the return journey</i>	
	1. Ensure equipments securely loaded	
	2. Monitoring and documentation	
	3. Appropriate road speed	
	4. Logical approach to troubleshooting	
	5. Appropriate handover	

ANNEX 4: USEFUL FORMULAS

Formula to calculate weight in kg 1–10 years $\cdot 2 (\text{Age} \cdot 4)$.

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

Blood pressure guidelines:

Minimum mean blood pressure by

Age: Preterm $\cdot \cdot$ 28 days old

Mean BP (mmHg) \geq Gestational age (weeks)

Infants and children

Neonate 40 mmHg

3 months 45 mmHg

6 months–3 years 50 mmHg

7–10 years 60 mmHg

.....
 12 years

70 mmHg

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

Anterior (medial) surface of tibia (ensure can access easily) 2–3 cm below tibial tuberosity

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 6–8 Fr Foley with balloon



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

Patient Transfer Form

	Referring hospital	Receiving hospital
Consultant & contact number		
Date of admission/ transfer		
Diagnosis at admission		

Brief clinical details:

.....

Transfer from: Ward A& E High dependency ICU SCB

Transfer mode: Land Air

Equipments checked prior to transfer: Yes No

Drugs checked prior to transfer : Yes No

Urgency of transfer¹: Emergency Urgent Elective

Reason for transfer: Lack of bed Surgical More specialized care Evaluation & procedures

Time of departure: hrs. min.(am./ pm.) **Time of arrival:** hrs. min.(am./ pm.)

Ventilation details: Mode of ventilation: Spontaneous Ambu bag Mechanical

Et tube size	
ETT depth	
Fluids	1.
	2.
	3.
No and sites of the lines	1.
	2.
Central line:	
Drugs given during transport:	
Drug infusions during transport	
Known allergis	

Monitoring:

Time								Rate			
RR								PIP			
Pulse								PEEP			
BP								FiO2			
Temp								ETCO2			
Pupil size & reaction								O2sat			
Sat								Vt			
ETCO2								Rate			
Et / drains depth								PIP			

Transfer comments: (including description of adverse events)

.....

.....

Transfer outcomes: uneventful with complications death

Receiving doctor . (comments)

.....

.....

Name & Signature of escorting team:

Name & Signature of receiving team:

