7 Transfer of the Surgical Neonate

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Abstract

Neonatal surgery is increasingly delivered in regional or even supra-regional centres with the specific aim of improving short and long-term outcome for complex congenital conditions. This arrangement permits the concentration of a multidisciplinary team of experts equipped with the wide range of skills required to successfully manage the specific challenges posed by the newborn surgical patient. Neonatal intensive care for these patients may need to commence immediately after delivery or may be only required following surgical intervention. It is essential therefore that nurses and clinicians in units which may potentially receive surgical neonates have the appropriate competencies required for the initial stages of management.

This chapter will discuss in utero transfer, the general principles of neonatal stabilisation prior to and during transfer, important principles of the transfer itself and condition specific considerations for common neonatal surgical conditions.

Keywords

Neonatal surgery • Neonatal transport • Guidelines

7.1 Introduction

Neonatal surgery is increasingly delivered in regional or even supra-regional centres with the specific aim of improving short and long-term outcome for complex congenital conditions. This arrangement permits the concentration of a multidisciplinary team of experts equipped with the wide range of skills required to successfully manage the specific challenges posed by the newborn surgical patient. Neonatal intensive care for these patients may need to commence immediately after delivery or may be only required following surgical intervention. It is essential therefore that nurses and clinicians in units which may potentially receive surgical neonates have the appropriate competencies required for the initial stages of management [1].

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7.2 In Utero Transfer

With increasing antenatal diagnosis of congenital anomalies there is often the opportunity to plan the transfer arrangements in advance. Most babies born with complex surgical conditions are relatively stable and can therefore be delivered and initially managed safely in any appropriately equipped and staffed neonatal unit. There are however specific advantages of in utero transfer in certain conditions. The most significant of these is the ability to deliver a baby with a known complex condition in an environment where all potential therapeutic requirements (staff and equipment) are readily available. This enables optimal timing of appropriate specialist interventions without the need for a potentially difficult postnatal transfer in a high risk newborn. An example of this would be in a fetus with an antenatally diagnosed congenital diaphragmatic hernia who may need immediate specialist ventilatory management and rapid access to extracorporeal membrane oxygenation.

It is not without its own risks however. Transferring a mother pre-delivery can lead to a prolonged antenatal hospital stay, far from friends and family in an unfamiliar environment and with unfamiliar staff. In utero transfer should therefore only be considered if the local unit cannot provide appropriate immediate care or a postnatal transfer is considered to be high risk.

7.3 Pre-Transfer Stabilisation

Many complex surgical conditions are not diagnosed antenatally—and even pre-diagnosed babies don't always follow pre-considered plans—so any hospital offering maternity services must be fully prepared to initiate resuscitation and stabilisation prior to transfer to a specialist surgical unit for definitive repair. The general principles of management of a baby born with a surgical condition are initially little different to those applied to a medical neonate [2]. The initial aims are to ensure optimisation of blood pressure, oxygen saturation, blood glucose and blood gases to minimise the risk of secondary injury as result of poor resuscitation, ensuring a baby is in the best possible clinical condition prior to the transfer occurring [3].

The key features of stabilisation are:

- Appropriate airway and respiratory management
- Adequate monitoring of Heart Rate, Blood Pressure and Oxygen Saturation
- Appropriate lines and tubes in place, functioning and secure
- Condition specific management initiated when vital signs stabilised

A checklist for stabilisation may be a useful *aide memoire* [2] (Fig. 7.1).

7.4 General Principles of Transfer

Transfer of the surgical neonate is often provided by specialist neonatal retrieval teams based in the regional centre. These teams should comprise of an appropriately trained and experienced doctor and neonatal intensive care nurse who can guide initial resuscitation, initiate an appropriate level of neonatal intensive care and stabilise the surgical neonate prior to transfer back to the regional unit. As detailed above appropriate prior stabilisation permits a controlled and safe transfer, minimizing risk to the patient and the transfer team. Again, a Transport Checklist (Fig. 7.2) may be useful.

Fig. 7.1 Stabilisation Checklist. From: Scottish Neonatal Transfer Service Stabilisation Handbook. Greig C, Mitchell A, et al. 2007; used with permission

Airway
Is airway patent and secure?

Breathing
Is endotracheal intubation and mechanical ventilation required prior to transfer?

Circulation
Has baby been adequately fluid resuscitated to place heart rate and BP within an acceptable range? Is inotropic support required to maintain adequate perfusion?

Temperature
Ideally skin-core perfusion should be monitored to aide assessment of peripheral perfusion. The baby should be stabilised in a thermoneutral environment where possible. It should be remembered that heat loss is considerably increased with exposed viscera (e.g. gastroschisis)

Metabolic
Electrolyte, glucose and acid-base balance should be optimised prior to transfer ideally

Infection
Have appropriate antibiotics been given either for treatment or prophylaxis?
Has this been clearly documented?

Comfort
Has the need for analgesia been considered or given prior to transfer?
Has this been clearly documented?

Safety
Is all necessary equipment for transfer available and working?
Is the baby clearly identified with two name bands?

Tubes
Does the baby require a nasogastric tube to be passed for decompression aide ventilation and to reduce the risk of aspiration?
Is vascular access adequate and secured?
Is a urinary catheter required?

Parents
Are parents informed of the condition of their baby?
Has a provisional plan been discussed with them?

Condition specific treatments
Are any condition specific interventions required prior to transfer?

7.5 Mode of Transfer

The decision on the appropriate mode of transfer is dependent on a number of issues such as geography, weather, distance to travel and the condition of the infant. All have specific advantages and disadvantages. Road transfer is cheap, quick to initiate, with good patient accessibility and relatively weather immune but can be slow. Helicopters are quick, can fly at low altitude if necessary but require an appropriate landing site, have limited space, can compromise patient assessment with noise and vibration, are expensive and are weather limited. Fixed wing aircraft are quieter, quicker over long distance and can have more space but are also expensive, take longer to organise and need a land transfer to and from the airport to the hospital.

Transport incubator. The modern transport incubator should be capable of providing high

Fig. 7.2 Transfer Checklist

Medical and nursing record
Has all relevant initial resuscitation and management been documented and copied for the transport team to take?

Drugs
Have all drugs administered been documented?
Has Vitamin K been given and documented?

Results of investigations
Are all relevant results available including biochemistry, haematology, microbiology and blood gases?

Imaging
Are copies of relevant imaging available to be taken by the transport team?

Maternal Blood sample
This may be required for testing if neonatal blood transfusion is required.
Is it must be accurately and appropriately labelled with all maternal details?

Parents
Are parents informed of the condition of their baby? Has a provisional plan been discussed with them? Do they know where their baby is being transferred to and have arrangements been made for them to get there? Do parents and transport team have accurate contact phone numbers?

performance respiratory support with optimal thermoregulation during transfer. It should have facilities for continuous monitoring of heart rate, blood pressure and oxygen saturation and ideally advanced ventilatory monitoring. It requires both air and oxygen cylinders and suction equipment, battery operated pumps to administer drugs and fluids together with the ability to access external power and gases when available. It should be robust and must have the facility for secure fixation to the transport vehicle of choice during transfer. It should carry a full range of emergency equipment and drugs required for maintaining and if necessary escalating intensive care during transfer. The transport team must be familiar with all aspects of the equipment and have the ability to "trouble shoot" during the transfer if required.

7.6 Parents

In the difficult period of initial resuscitation and stabilisation it is easy to overlook the parents. They may have had an antenatal diagnosis and subsequent counselling to prepare them for what is likely to happen but with many surgical conditions the diagnosis is only made at delivery. There is often—quite appropriately—considerable anxiety and concern about their newborn child and the need for a transfer to a regional centre will only increase that. It is essential therefore that parents are informed of and involved in decision making as much as is practically possible. It is important to discuss with parents the reason for transfer, a provisional plan, the mechanism and destination of the transfer and the likely time scale. In addition parents need contact details of the receiving unit and travel directions, ideally in written form. They should get the opportunity to see their baby prior to transfer and ideally have a photograph taken. It is possible that a mother may have just undergone a surgical procedure herself and is unable to travel with her baby so the transferring team must make every effort to keep her informed.

7.7 Consent

Consent for any proposed surgical procedure may cause difficulty if a baby is transferred to specialist centre. If possible one parent (who has the legal right to consent) should accompany the baby to permit the operating surgeon to discuss the risks and benefits of surgery prior to obtaining informed consent. A consent form sent with a baby which has been signed by a parent without this discussion has limited legal standing. If a parent cannot accompany the infant then consent can be obtained via a telephone conversation with the operating surgeon.

7.8 Condition Specific Considerations

7.8.1 Gastroschisis

This is often diagnosed antenatally allowing a postnatal management plan to be in place. The significant risks are fluid and heat loss and kinking of the mesentery leading to venous congestion of the exposed bowel. Intravenous access with careful fluid management is essential, broad spectrum antibiotics should be started, Vitamin K given and a wide bore naso/oro gastric tube passed. This must be aspirated every 15 min during transfer to ensure the risk of aspiration of gut contents is minimised. The exposed bowel can be placed in a sterile "bowel bag" for transfer or the abdomen can be carefully wrapped in clear plastic film to both reduce fluid loss and stabilise the bowel. Avoid the use of saline soaked swabs as this can accelerate heat loss. The baby should be nursed in the left lateral position to prevent kinking of the vascular pedicle. Thermoregulation is optimised by nursing and transferring in a heated incubator.

7.8.2 Oesophageal Atresia and Tracheo-Oesophageal Atresia

Unless this is a pure oesophageal atresia this condition is rarely diagnosed antenatally. The major initial risk is aspiration of unswallowed saliva. To prevent this, the baby should be nursed in the lateral or prone position and a 10 Fr Replogle tube should be placed in the upper pouch [4]. This should be placed on continuous suction at low pressure (5 kPa (35–40 mmHg)) with frequent irrigation of the air channel to prevent blockage. If a Replogle is not available a wide bore feeding tube can be used but this must be aspirated every 15 min during transfer. The volume of aspirated saliva should be recorded and replaced. Intravenous access with careful fluid management is essential, broad spectrum antibiotics should be started and Vitamin K given. The risk of associated abnormalities, including cardiac, should be considered. Thermoregulation is optimised by nursing and transferring in a heated incubator.

7.8.3 Congenital Diaphragmatic Hernia

This is increasingly diagnosed antenatally but will still often present with severe respiratory distress at birth. If antenatally diagnosed an in utero transfer to an appropriate regional facility that can provide optimal management is the preferred option. If diagnosed at birth endotracheal intubation should be performed with minimal bag/valve/mask ventilation and early passage of an oro/nasogastric tube. Pre and post ductal arterial monitoring and venous access should be initiated and a ventilation strategy of permissive hypercapnia to minimise barotrauma instituted. There is an increased risk of pneumothorax so equipment necessary to inset a chest drain should be available during transfer.

7.8.4 Myelomeningocele

This condition is also is increasingly diagnosed antenatally permitting a postnatal plan to be prepared in advance. The exposed spinal lesion should be covered with a non adherent dressing and the baby nursed in the prone position. The use of saline swabs should be avoided as this can cause significant heat loss. Latex exposure should also be avoided as these children have a high incidence of latex allergy which may be due to early repeated contact.

7.8.5 Intestinal Obstruction

The general principles of transfer of a neonate with intestinal obstruction from any cause are similar. The major risks are aspiration of intestinal contents and fluid depletion. A wide bore naso/oro gastric tube should therefore be passed and placed on free drainage. In addition it must be aspirated regularly during stabilisation and transfer. The volume aspirated should be accurately measured, documented and replaced. Intravenous access with careful fluid management is particularly important as fluid loss may be significant. Vitamin K should be given and broad spectrum antibiotics be considered. In addition it is important copies of all X-rays are sent with the patient.

7.9 Back Transfer of the Post-Operative Neonate

This should be considered as soon as the infant's condition permits it. Early back transfer has the advantage of returning child and parent close to home, freeing up specialist surgical cots and permits maintenance of medical and nursing skills in the referring units. For this to be considered the receiving unit should have the staff and facilities to provide for the infant's predictable future needs, the remaining estimated length of in hospital stay should is balanced the costs and risks of reverse transport and the parents views should be considered. It is rarely an emergency and can therefore be carefully planned. As the post-operative patient will usually be relatively well a reduced transport team can often provide this transfer.

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