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Stabilising the newborn for transfer

Basic principles

Background

Rural general practitioners involved in obstetric service delivery may have occasion to support the sick or premature newborn requiring transfer. This should be achievable for short periods of time in most rural hospitals.

Objective

This article discusses the planning priorities, and the equipment and skills required for care of the sick or premature newborn.

Discussion

With careful planning, attention to detail, and maintenance of clinical skills and equipment, newborn intensive care can be provided in most hospitals for brief periods while awaiting the arrival of the retrieval team.

■ **National neonatal retrieval service details are listed in Table 1. It is important to keep these in easy view. One telephone call is enough to initiate tertiary referral including advice, bed finding and retrieval – leaving the general practitioner to provide clinical care to the newborn.**

In situations of newborn extremis, teleconferencing can be staggered over 2–3 telephone calls if required, providing advice to enable efficient resuscitation, stabilisation and initiation of retrieval. A current Apgar¹ score on the newborn is a useful way to convey the clinical state efficiently in a teleconference scenario.

Call as early as possible

It is vital for GPs to be able to anticipate the need for retrieval and initiate contact early. Waiting until all clinical information is available may cause considerable delay, which may affect the clinical outcome.

Equipment and skills

Available equipment will vary from hospital to hospital. *Table 2* outlines desirable equipment for hospitals that provide obstetric services. *Table 3* outlines skills useful in newborn resuscitation. Health services should support newborn resuscitation refresher courses and equipment updates for clinicians involved in neonatal resuscitation. A national Neonatal Resuscitation Program is being established. Courses will be available for doctors, nurses and paramedics.

Assessment

History

- Maternal – age, parity, obstetric history, blood group and antibodies, medical illnesses, medications and any illicit drug or pertinent social history



Table 1. National neonatal retrieval services

NETS (Victoria)	1300 13 7650
NETS (New South Wales)	1300 36 2500
QNETS (Queensland)	1300 79 9127
WANTS (Western Australia)	08 9340 8777

Table 2. Equipment required

- Warm room with a resuscitaire with the means of providing/maintaining warmth, overhead heater, cling film (eg. Glad® Wrap)
- Infant head box for providing ambient oxygen
- Neopuff™ Infant Resuscitator
- Newborn self inflating bag and masks – sizes 0/0, 0/1, 2
- Size 6, 10, 12 suction catheters
- Oropharyngeal airways – sizes 000, 00, 0, 1
- Endotracheal tubes – internal diameter 2.5 mm, 3 mm, 3.5 mm, 4.0 mm
- Introducer, Magill's forceps, laryngoscope and size 00/0/1 neonatal blades
- CO₂ detector (eg. Pedicap®)
- Oxygen analyser
- Air and oxygen supply with blender
- Humidifier
- Oxygen saturation monitor with neonatal probe and Coban® to secure
- 500 mL bags of 10% dextrose and burette. Preferably a paediatric syringe driver or intravenous pump
- Size 24 g cannulae, umbilical catheter or size 5 Fr gauge feeding tube
- Neonatal intra-osseous cannula
- Ideally, a hands free headset telephone to enable easy communication with retrieval coordination and consultation while resuscitating
- Digital camera and access to email for communicating images and radiology when operating at a distance

- Antenatal – dates and how they were derived, complications, results of antenatal ultrasounds if available, and results of antenatal screening including low vaginal swab for Group B *Streptococcus*
- Labour – onset, time of rupture of membranes, presence of meconium, duration and stages of labour
- Delivery – type and presentation, placental condition and location. A history of instrumental delivery, cord entrapment and cutting the cord before delivery of the baby are all clues to bleeding, which may result in hypovolaemia
- Appearance of the placenta (NB: do not discard the placenta)
- Newborn – Apgar score, symptoms, birth weight.

Examination

Temperature

Keep the newborn warm. Assess temperature regularly and maintain normothermia – 36.1–37.1 degrees celsius.

Airway

Assess for patency of oropharynx and nasal passages, quality of cry; look for micrognathia, other dysmorphism and assess palate.

Breathing

Assess for apnoea, work of breathing (respiratory rate, presence of sternal, subcostal or intercostal recession, nasal flaring, stridor, grunting). Assess air entry, chest expansion and symmetry. Neonatal pneumothorax is common in both term and preterm newborns.

Oxygen saturation

Oxygen saturation is a valuable tool during postnatal adaptation as newborns can be difficult to assess clinically. The ductus arteriosus is usually still open in the first few hours of life with a right to left shunt. Oxygen saturation on the right arm is indicative of oxygen saturation of blood flowing to the brain before ductal entry into the descending aorta. With normal postnatal adaptation, pulmonary pressures fall and the shunt becomes mainly left to right until closure (with no effect on saturations).²

When pulmonary hypertension persists resulting in ongoing right to left shunting, oxygen saturations in the left arm may be low. This situation can be complicated to manage and early consultation is mandatory.³



Table 3. Skills for resuscitation of the newborn

Skill	Detail
Assessment	Assessment of the newborn at delivery with regards to colour, reactivity, respiratory effort, heart rate and tone
Airway support	Assessment, positioning, bag and mask ventilation, intubation and establishment of a definitive airway*
Access	Intravenous and intra-osseous access
Accurate documentation	The following must be documented: <ul style="list-style-type: none"> • time and detail of interventions during resuscitation • time to establishment of heart rate and respirations
Ability to communicate effectively with the retrieval team	Communication of accurate clinical scenarios to expedite appropriate care

* If the GP is unable to intubate, a plan should be in place to call in a person with this skill such as an on-call anaesthetist or senior GP. Failing this, adequate oxygenation may be maintained by bag and mask until the retrieval team arrives. In most situations, the need for intubation can be predicted and the need to intubate as an emergency is unusual before the arrival of the retrieval team. Teleconferencing can aid in the decision and in the practicalities of positioning the endotracheal tube appropriately in the newborn

Circulation

Pallor can indicate acidosis and poor perfusion or hypovolaemia. Clinicians should maintain a high index of suspicion of blood loss even in the absence of a history of bleeding. Carefully examine the scalp for fluctuance of the suture lines indicating subgaleal haemorrhage and the abdomen looking for fullness or discolouration from intra-abdominal bleeding. Assess pulse rate and volume of femoral and brachial pulses. Check blood pressure (BP). The 10th percentile of mean arterial pressure in the newborn is generally greater than or equal to gestational age (eg. 28 mmHg at 28 weeks gestation).⁴ Assess capillary return, heart sounds, presence of murmurs and liver size.

General assessment

Assess tone, posture, responsiveness and activity of the neonate. Look for dysmorphic features, rashes or vesicles indicative of congenital infections. Photograph any lesions found.

Investigations

Glucose

Assess early and correct with 2 mL/kg of 10% dextrose if hypoglycaemic (<2 mmol/L).

Bloods

Full blood count (FBC) and blood culture should be performed before commencement of antibiotics if possible. Arterial or venous blood gases can help assess acidosis and adequacy of gas exchange.

Chest/abdominal X-ray

Remember newborns have a large mediastinum due to the thymus. Seven to eight posterior ribs would indicate adequate lung expansion. Look for pneumothorax, congenital abnormalities such as diaphragmatic hernia, oesophageal atresia, lung parenchymal disease such as respiratory distress syndrome (ground glass appearance,

small volume lungs), or pneumonia (more focal or patchy areas of consolidation/collapse). An increase in cardiothoracic ratio to >0.6 may indicate congestive heart failure.

Placenta

The placenta must be kept for histopathological examination – a plastic bag and sealed bucket is all that is necessary for safe carriage.

Further investigations may be required in specific situations on advice from the retrieval service.

Management

Maintaining warmth

Studies from Paris in the early 1900s showed that keeping preterm newborns warm increases the survival rate by 50%.⁵ Cold can result in hypoglycaemia and worsening respiratory distress (surfactant requires warmth to function).⁶ The only exception to this rule is the asphyxiated neonate where management may involve therapeutic cooling.⁷ In this situation, discuss early with the retrieval service.

Airway

Maintain in the neutral position and ensure patency. Remember a crying baby has a patent airway. Gentle suction may be necessary. If obstruction is noted and airway positioning has not helped, try an oropharyngeal or nasopharyngeal airway. A nasopharyngeal airway is simply an appropriately sized endotracheal tube inserted to the level of the pharynx (measure from the nasal philtrum to the tragus of the ear and insert this far). Assess the nares for patency with passage of a 5 Fr gauge feeding tube. If obstruction remains a problem, expert help may be needed.

Provided the newborn is monitored, prone positioning may alleviate some upper airway obstruction – if this is effective, then the newborn should be allowed to maintain their airway with minimal handling. In situations of airway obstruction, endotracheal intubation should only be attempted by skilled personnel.



Breathing

After general anaesthetic or maternal narcotic administration, the newborn may need time to establish spontaneous respirations. Any newborn exposed to maternal narcotic within 4 hours of delivery should have cardiorespiratory observations every 15 minutes for the first 2 hours of life. Naloxone may be used, however, in this case cardiorespiratory observations should continue for 4–6 hours (the elimination half-life of naloxone in the newborn is fast relative to metabolism and excretion of pethidine).⁸

Naloxone is contraindicated where there is maternal history of illicit narcotic use or methadone use. An apnoeic, narcotic dependant newborn can quickly develop serious withdrawal, with seizures. For this reason, naloxone should be used with caution. Supportive care will get most newborns through this period without the use of naloxone.

If the newborn is apnoeic or hypoventilating try gentle bag and mask ventilation. An orogastric tube should be inserted to vent the stomach. Oxygen saturation should be monitored. If oxygen saturation is <90%, increase the ambient oxygen either via a head box, or crib if available. Head boxes require a flow of at least 10 L/min to achieve adequate concentration and prevent CO₂ retention.

Targets for oxygen saturation vary on gestational age and pathology. Newborns <30 weeks gestation are maintained with oxygen saturations of 88–93% – this provides good developmental outcomes balanced against the risk of high ambient oxygen concentration and retinopathy of prematurity.⁹ Term newborns can have oxygen targeted a little higher; around 95% in asphyxiated newborns and 100% in situations of pneumothorax or pulmonary hypertension.

Newborns are accustomed to low oxygen tensions and tolerate them quite well (the PaO₂ of the fetus is ~20–30 mmHg).¹⁰ Oxygen over administration may lower pulmonary vascular resistance which can lead to increased left to right flow through the ductus arteriosus and decreased systemic flow in lesions where the systemic circulation is dependant upon the ductus arteriosus for survival.¹¹ Oxygen administration to newborns with ductus dependant pulmonary blood flow does not close the ductus arteriosus or worsen hypoxaemia.

If head box oxygen is not sufficient, ventilation may be required with a Neopuff™ Infant Resuscitator and mask rather than bag and mask. The Neopuff™ Infant Resuscitator provides more consistent ventilation than bag and mask and is the safest method for infrequent providers of newborn ventilation.¹² If you do have access to a Neopuff™ Infant Resuscitator, then continuous positive airway pressure (CPAP) can be applied to support the newborn's own efforts at spontaneous respiration.

Intubation

The decision to intubate and ventilate can depend on the situation and the individual practitioner's degree of comfort with the procedure. Success of intubation in the newborn is confirmed by:

- visualising the endotracheal tube passing through the vocal cords
- a CO₂ detector – Pedi-cap® (Figure 1)

- clinical response – improving colour, rising heart rate, oxygen saturations and equal chest movement
- misting in the endotracheal tube
- chest X-ray (ETT should be between the clavicles or between vertebral levels C7–T3).

Ventilation is individualised to the newborn aiming for adequate, though not excessive, chest movement and normal arterial blood gases. Again, talk to the retrieval service if in doubt. If you have an infant ventilator available you could start with an inspiratory pressure of 20 cm of H₂O and end expiratory pressure set at 5 cm of H₂O with a rate of 30/min (term newborn) or 60/min (preterm newborn). Inspiratory pressure should be titrated to chest movement, oxygenation and PaCO₂.

If a ventilator is not available then pressures and rates are provided manually, again utilising a Neopuff™ Infant Resuscitator. In a situation of prolonged manual ventilation, early contact with the retrieval service is mandatory to limit the time required – not only is this taxing on staff resources it is also not ideal for sensitive newborn lungs.

Circulation

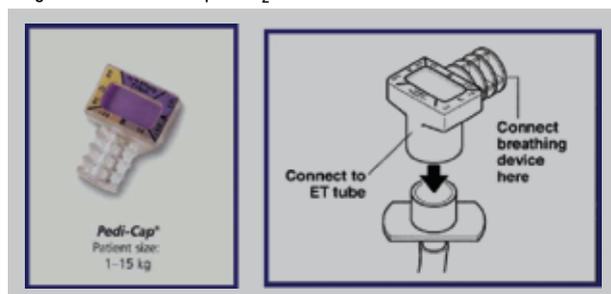
Intravenous access is important as most sick newborns requiring transfer or those in respiratory distress will be nil by mouth and require intravenous antibiotics. Cannulate a hand vein or scalp vein and collect blood for glucose, FBC and culture at the time of insertion. If access is difficult, an umbilical venous catheter can be inserted, sometimes up to 2 weeks of age. The umbilical catheter should be secured to the abdomen without kinks in the tubing – close monitoring will be required as accidental dislodgement can lead to massive haemorrhage.

If you do not have an actual umbilical catheter a 5Fr gauge feeding tube inserted to 5 cm can be used. In emergency situations where the umbilicus is no longer an option, or for some reason it is unable to be accessed, an intra-osseous needle can be used. Remember that you can also check the blood glucose and pH from the intra-osseous needle. However, a FBC is not as reliable from an intra-osseous sample as it is from peripheral blood.

Fluids

If shock is present then a bolus of 10 mL/kg of normal saline can be given either as a push or over 20 minutes. This may be repeated once if necessary. Again, discussion with the retrieval service can help if

Figure 1. The Pedi-cap® CO₂ detector





in doubt. If there is no evidence of shock, the newborn will require maintenance fluid and dextrose. Ten percent dextrose at 60 mL/kg/day is generally appropriate on day 1 of life. On subsequent days, type of fluid and rate needs to be tailored to the individual.

Sepsis

Any unwell newborn is at risk of sepsis. Pre-emptive treatment can prevent rapid deterioration and death. The main pathogenic microorganisms are Group B *Streptococcus*, *Escherichia coli*, *Klebsiella pneumoniae* and listeria; hence, following blood cultures, doses of ampicillin and gentamicin should be given.¹³

Monitoring

Inspired oxygen concentrations, oxygen saturations, BP, pulse, capillary refill, effort of breathing and temperature should be monitored every 30 minutes. Blood glucose levels should be monitored every 2 hours if stable on intravenous dextrose. Arterial blood gas monitoring will depend on the emerging clinical situation.

Surfactant

Use of surfactant requires skilled assessment and ventilation of the newborn. It is usually only available in tertiary centres and some

rural centres. Lung compliance can fall rapidly after administration and significant barotrauma can occur if ventilation is not weaned aggressively. The use of surfactant should always be discussed with the receiving neonatologist and retrieval service. It may be appropriate in a premature baby with respiratory distress to administer before the retrieval team arrives depending on the clinical situation, the skills of those involved, and the length of time the retrieval team will take to arrive.

Preparing the family

Retrieval teams arrive with equipment that may seem imposing to parents (*Figure 2, 3*). It is useful to warn them of this before beforehand.

Conclusion

In utero transfer improves maternal and preterm newborn outcomes and this is the goal of perinatal services.¹⁴ Despite this, there are still some term and preterm newborns born in regional and rural centres requiring intensive care. With careful planning, attention to detail, and maintenance of clinical skills and equipment, newborn intensive care can be provided in most hospitals for brief periods while awaiting the arrival of the retrieval team. Early contact with the retrieval service and ongoing consultation during the process will help rural and regional centres to provide optimal care and outcomes.

Conflict of interest: none declared.

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Figure 2. Newborn being transferred



Figure 3. Newborn being transferred

