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Authors:	**Sara Watkin, amended by Jon Dorling Nov -10, S Wardle Feb 2014**
Job title:	**Consultant Neonatologists**
Consultation:	**Nottingham Neonatal Intensive Care Unit Staff.**
Guideline contact:	**Jon Dorling (Consultant Neonatologist) c/o Stephanie Tyrrell, Nottingham Neonatal Service stephanie.tyrrell@nuh.nhs.uk**
Distribution:	**Labour ward, Obstetric Theatres & Neonatal Units**
Target Audience:	**Staff of the Nottingham Neonatal Service and Labours wards on QMC and City Campuses**
Patients to whom this applies	**Newborn infants born in Nottingham who fit the inclusion criteria of the guideline below**
Key words:	**Neonatal team, Delivery Suite, Delivery, Newborn**
Risk managed:	**Effective resuscitation**
Evidence used:	**The contemporary evidence base has been used to develop this guideline. References to studies utilised in the preparation of this guideline are given at its end.**

Clinical guidelines are guidelines only. The interpretation and application of clinical guidelines remain the responsibility of the individual clinician. If in doubt, contact a senior colleague. Caution is advised when using guidelines after the review date. This guideline has been registered with the Nottingham University Hospitals NHS Trust.

1 Introduction

This policy describes the procedures to be carried out during resuscitation of the newborn infant on the labour suite only. A policy statement on the decision not to resuscitate is to be found in Appendix 2. The contents of this guideline are based on the Newborn Life Support (NLS) Course [1].

The indications for a neonatal SHO / ANNP being present at delivery are discussed in Neonatal Guideline A2. For infants born before 28 weeks gestation please see the 'Early Care Guideline' A8.

Most mature babies will breathe or cry within 90 seconds of birth and very few will need resuscitation. However sometimes the need for resuscitation is unpredictable. The frequency with which resuscitation is required is difficult to determine because the fact that a baby received resuscitation does not necessarily mean it was required. However in a study from Sweden of babies > 2.5 Kg approximately 10 babies per 1000 received mask ventilation and only 2 per 1000 were intubated [2].

The objectives of resuscitation are to prevent or minimise asphyxial injury, to provide immediate respiratory and cardiovascular support where required, to prevent hypothermia and hypoglycaemia and to provide explanation and reassurance to parents.

2. Resuscitation team

On the labour suite this will comprise of the neonatal SHO / ANNP and the midwife attending the mother. The neonatal SpR and a second midwife should be summoned immediately if further help is required. The SpR's assistance and the assistance of a Neonatal Nurse should be requested in advance for all infants being born at ≤ 30 weeks gestation, and for all infants where the fetal heart rate is lost prior to delivery.

In addition, until an SHO / ANNP is competent in resuscitation of preterm babies >30 weeks gestation and babies with other clinical problems, eg. meconium aspiration syndrome, he / she should request the attendance of the SpR at these deliveries. For multiple births of <33 weeks gestation, or where the babies are being delivered by Caesarean section, there should be at least one professional competent in advanced neonatal life support present per baby.

3. Resuscitation of the newborn infant at delivery (for summary see Appendix 1)

3.1 Procedures prior to delivery

- Liaise with obstetricians and / or midwives
- Obtain obstetric history
- Call for the Registrar if the infant is < 30 weeks gestation or there is loss of fetal heart beat.
- Introduce yourself to the parents
- Check Resuscitaire:

a. Is the heater switched on? Is the delivery room warm enough (25^{o}C)?
b. Are both oxygen supplies switched on and working?
c. Is the pressure-limiting valve set at 30 cmH_2O?
d. Is the suction working and the pressure set at no greater than 100 mmHg (13.3KpA, 4"Hg)? (In general the maximum negative pressure used should be no more than 100 mmHg (13.3KpA, 4"Hg). Occasionally, with thick meconium, the pressures may need to be increased to a maximum of 200 mmHg (26.6KpA, 8"Hg)).
e. Are ET tubes available?
f. Is the laryngoscope illuminating effectively? Test the light by depressing green button in handle, additional handles can be obtained from labour ward reception or another room / resuscitaireg. Are there some dry, warm towels to wrap the baby in (babies >32 weeks)?
h. Is there a plastic bag for the infant (babies < 32 weeks) [3]?

3.2 Procedure at delivery

The following approach should always be used:-

- ***Dry and cover the baby***
- ***Assess the situation***
- ***Airway***
- ***Breathing***
- ***Chest Compressions***
- ***(Drugs)***

- Start the clock
- Transfer baby to resuscitaire
- **> 32 weeks** Dry baby off, remove wet towels and wrap in warm towel.
- **≤ 32 weeks** Put infant directly into a plastic bag without drying [3].
- Ensure that the head is covered.

NB: To prevent heat loss, these procedures must be done however sick the infant.

- Assess the condition of the infant:

Breathing Normal respiration or gasping
Colour Colour is assessed by looking at the baby's lips and trunk and not his peripheries.
Heart rate May be assessed by compressing the umbilical cord but is best assessed by auscultation.
Tone Assess whilst drying the infant. Babies with good tone are usually OK.

- Having assessed the baby resuscitation and management should proceed in the following order:-

Airway Open the airway
Breathing Inflate the lungs and breathe for the baby
Circulation Ensure an effective circulation with chest compressions if necessary
Drugs Consider drugs to achieve this if initially unsucessful

BREATHING / CRYING, GOOD HEART RATE, CENTRALLY PINK

Dry infant and give to mother. Ideally these babies should be delivered directly onto their mother's abdomen and dried with a towel. Temperature is then maintained by direct skin to skin contact.

BLUE, INADEQUATE BREATHING, SLOW HEART RATE AND REASONABLE TONE

Wait for a minute or so. Regular breathing usually starts spontaneously within a minute of delivery but healthy babies can take up to three minutes to start breathing after birth [4]. If apnoea continues then open the airway and give inflation breaths.

BLUE / PALE/ WHITE, APNOEIC, SLOW/ VERY SLOW HEART RATE, FLOPPY

Babies with a low heart rate who are not breathing could be in primary or terminal apnoea.

- Open the airway (head in neutral position, jaw thrust)
- give five inflation breaths (30cm H2O, 2-3 second inflation time)

Inflation breaths should be long higher pressure breaths to remove lung fluid [5]. Until the lungs are inflated they are filled with fluid and the infant will not improve.

Ensure that the chest moves with each inflation breath. If it does not then go back and reposition the airway (head in neutral position, jaw thrust). If the chest still does not move then consider in addition:-

1. Two person jaw thrust OR
2. A Guedel airway OR
3. Longer inflation time or increased pressure OR
4. Suction under direct vision.

Remember : Airway obstruction is almost always due to decreased pharyngeal tone not obstruction.

If the chest moves well with inflation breaths after 5 breaths:

- Reassess:

If the heart rate is responding continue ventilation breaths (0.5 second inflation time, 30 bpm) until the infant is breathing. Note the time at which this occurs and whether the breaths are gasping or normal.

If the heart rate does not respond :-

- Continue ventilation breaths (0.5 second inflation time, 30 bpm) ensuring that there is good chest movement. If there is not go back and recheck the airway as above. If the chest is moving continue.

- Reassess the heart rate (after 30 seconds to 1 minute).

If the heart rate remains low ***and*** the chest is moving:-

- Commence external cardiac compressions

Compress the chest at a ratio of 3:1 with ventilation breaths. If an experience intubator is present it is worth intubating to stabilise the airway at this point. If an experienced intubator is not present continue T-piece / bag-mask ventilation.

The commonest reason for failure of the heart rate to improve is ineffective lung inflation. Check this is correct before commencing cardiac compressions.

If the heart rate remains low (<60) despite adequate chest inflation and external cardiac compressions, then a UVC should be inserted. In extreme cases where attempts at UVC have failed intraosseous access may be used. Intra osseous needles are available on both delivery suites.

At insertion of the UVC a baseline blood gas and blood sugar should be obtained.

The following drugs should be given (Appendix 3):-

a. Adrenaline:
10 μg / kg (ie 0.1 ml/kg of 1:10,000 solution) IV followed by a 0.5 - 1.0 ml normal saline flush.

If there is likely to be a delay in establishing IV access, then 20 mcg/kg of Adrenaline can be given via the ET tube if the baby is intubated. This should be given rapidly down a catheter placed to lie just beyond the end of the ET tube and followed by a 0.5-1.0ml normal saline flush and 5 rapid inflations. There is little evidence that the tracheal route is effective and this route should only be used whilst iv access is being established. **It must not be used in preference to iv access.**

Ventilation and external cardiac compressions should be recommenced and the heart rate re-assessed.

If there is no response, then after 1 minute give:

b. Sodium bicarbonate:
4.2% - 1 mmol / kg (i.e. 2 ml / kg) intravenously followed by a 0.5 - 1.0 ml normal saline flush.
This dose of Sodium Bicarbonate is not intended to correct the metabolic acidosis but to increase the pH within the coronary arteries and hopefully increase the action of the subsequent Adrenaline.

If there is no response then give

Further doses of Adrenaline 10 μg/kg IV every 3 to 5 minutes if there is no response. An increased dose of 30 μg/kg IV can be considered in this situation.

c. 10% Glucose: During the process of prolonged resuscitation, hypoglycaemia (i.e. whole blood glucose <2.6 mmol/l) may occur and this may interfere with adequate resucitation. Give 10% Glucose **2.5 ml/kg intravenously**, followed by a 0.5-1.0 ml. normal saline flush.

There is no place for calcium or atropine in resuscitation in the delivery suite.

NB: All drugs should be checked before giving and a record of drug administration kept.

The techniques of airway opening, suction, mask and T-piece ventilation, bag and mask ventilation, intubation, external cardiac compressions, UVC insertion are discussed in section 4.

3.3 Failure to respond to resuscitation at delivery

The following should be considered:

- If mask ventilation is being performed:-

a. Is the head position correct?
b. Do you need a second person to do the jaw thrust
c. Is the face mask of the correct size?
d. Is there a good seal?

- If baby is intubated and there is poor or absent chest movement:-

a. Is the ET tube in the oesophagus? – Poor chest movement will be seen.
b. Is the ET tube down the right main bronchus? Consider this if there is asymmetry of chest movement and breath sounds. Inflation and air entry will improve as the tube is withdrawn.
c. Is the inflation pressure adequate? If the ET tube appears to be in the correct position i.e. breath sounds present, symmetrical but poor chest wall movement then the most likely problem is that the baby is receiving insufficient pressure to open up the lungs, therefore:-

- In rare situations it may be necessary to use high pressures to 'open' the chest. Check the peak inspiratory pressure on the pressure manometer and increase to up to 40cm H_2O in steps of 30cm, 35cm, 40cm, trialing each for 30 seconds..
- Check oxygen/air flow rate. This should be set on the resuscitaire at 5-8 litres/minute for mask ventilation, and 3-5 litres/minute for ET IPPV.
- If increasing inspiratory pressure level, there is still poor or absent chest movement, consider increasing the inspiratory time.

d. Does the baby have lung pathology? e.g:-

- Pneumothorax
- Diaphragmatic hernia (Is there a scaphoid abdomen? Is the apex beat displaced?)
- Hypoplastic lungs (Does the child have signs of Potter's syndrome?)
- Pleural effusions
- Evolving lung disease such as severe respiratory distress syndrome
- Thoracic dystrophy (The baby may benefit from having the peak inspiratory pressure reduced.)

With good chest movement:-

a. Has there been fetal haemorrhage? Suspect if mother has had large antepartum haemorrhage or abruption.

Fetal blood loss is rare even with large antepartum bleeding [6,7] however if hypovolaemia due to fetal blood loss is suspected, then normal saline or plasma, should be given in a volume of 10-20 ml/kg, repeated as necessary. Uncross-matched O negative blood or blood cross-matched against mother can also be given but all blood must be obtained from blood bank as the blood in labour suite fridge may be relatively old.

b. Is there severe birth asphyxia?
c. Does the baby have severe cyanotic congenital heart disease?

3.4 Discontinuation of resuscitation

If there is no response in the term infant to resuscitation by 20 minutes (ie. the infant has no heart rate and respiratory effort) then resuscitation should be terminated. In extreme preterm babies resuscitation can be stopped well before this time. Termination of treatment should occur, if possible, after discussion with the parents. In term infants it is important this discussion begins with parents at around 15 minutes, enabling

resuscitation to be stopped at 20 minutes. The decision to discontinue treatment should be made by either the Registrar or Consultant: it should not be made by the SHO / ANNP.

3.5 Special situations

In each of these situations the approach to resuscitation should essentially be the same:- Dry, Assess, Airway, Breathing, Circulation, (Drugs)

3.5.1 Mothers who have received opiate pain relief

If with mask ventilation the baby becomes pink and has a good heart rate but does not breathe spontaneously **and** if mother has received opiate analgesia more frequently than 3 hourly or within 2-4 hours pre-delivery then naloxone may be given. Bag and mask ventilation must not be stopped whilst naloxone is being administered. **Naloxone must not be given to the infant of an opiate dependent mother as it can cause acute withdrawal.**

3.5.2 Meconium stained liquor

The normal breathing efforts of a baby in utero are not sufficient to inhale particulate meconium in significant quantities. It is therefore reasonable to assume that if a baby has inhaled significant quantities of meconium it is becaue it has been gasping. Meconium can enter the lung before or during birth but the subsequent hypoxia and persistent pulmonary hypertension that develop may be related to the meconium in the lung or more likely to the preceding hypoxia-ischaemia. As long as meconium is not blocking the airway it may be relatively harmless, which is possibly why laryngeal toiletting has been shown to have little positive effect [8].

Thin meconium staining of the liquor does not require intervention. Where there is thick or particulate meconium management is as follows (see Figure 1):-

If the baby is in reasonable condition treat as any other baby.

Screaming babies have an open airway
Floppy babies - have a look

If the baby is not breathing and has a low heart rate:-

Procede as above but before inflation breaths visualise the airway using a laryngoscope and suck out under direct vision. If skilled at intubation it is appropriate to intubate and suck directly below the vocal cords if not then just suck the oropharynx under direct vision. There is no place for bronchial lavage with saline which is known to be harmful [9,10]. One the airway is clear then procede as above.

3.5.3 The preterm infant

Resuscitation of the preterm infant should follow the principles described above. Consideration should be given to giving surfactant as early as possible, on the delivery suite if possible (see Early Care Guideline A8). Remember the surfactant deficient infant often requires an increased peak airway pressure when recieving IPPV.

Cardiac massage and cardiac resuscitation drugs should not be used in infants <25 weeks gestation where there is no heart rate response despite establishing an airway and appropriate breathing management. Withdrawal of resuscitation should be considered in these occasions. The decision to withdraw resuscitation should be made at a middle or senior grade level.

3.5.4 Higher order births

Higher order multiple births (triplets, quadruplets or more) are becoming more common as a result of the more frequent use of assisted reproduction techniques. The risk of prematurity is very high in this group and the simultaneous delivery of several infants below 30 weeks gestation can severly stretch neonatal resourses.

These pregnancies are usuallly diagnosd early and the neonatal unit must be aware especially after 24 weeks gestation. Close co-operation between obstetrics and neonatology is necessary to ensure sufficient resources are available for neonatal intensive care.

As with all preterm babies a neonatologist should meet with parents before delivery and the parents offered the opportunity to visit the neonatal unit. Delivery will usually be by caesarean section which makes planning easier. Where possible staff attending the resuscitation should be extra to the regular staff who will be required to attend the existing neonatal population and other deliveries.

At delivery one resuscitaire and one trained member of the neonatal staff should be available for each baby, and supported by an assistant who may be a midwife or a neonatal nurse. These two are responsible for the resuscitation, transfer to the neonatal unit and admission / stabalisation of each baby. This pair should write up the clinical notes once the initial admission tasks have been completed prior to handing over to the regular staff.

A consultant should be designated co-ordinator and act as a back up for the difficult resuscitation. He / she will be available to make decisions concerning the progress of difficult resuscitations.

3.6 Documentation

It is essential that all events that occur during a resuscitation are recorded accurately. In order to do this it is essential that a clock has been started at the commencement of resuscitation and accurate timings are recorded in the neonatal or the resuscitation page of the intrapartum booklet file in the maternal notes. All babies where more than inflation breaths are required should have their own set of case notes and information should be recorded on the resuscitation pages in the neonatal notes. Each event and intervention should be recorded and the easiest way of ensuring that this occurs accurately is if one individual has the responsibility of recording events, drug doses and timings etc.

Following a resuscitation it is essential that each individual involved records events that they participated in in the case notes remembering to accurately record the date and time at which they occurred as well as when they are documented.

3.7 Parents

Prior to the delivery of a baby, members of the team should introduce themselves to the parents of the child and explain what is going to happen if this is possible. Communication with the parents should continue during a resuscitation if it is prolonged however it is not always possible for those leading the resuscitation to communicate events directly to the parents so someone, usually a midwife or neonatal nurse, should explain to them what is happening.

Immediately after a resuscitation it is essential the most senior member of the team talks to the parents to explain the events and what has happened. They should explain the implications in terms of prognosis for the baby and what further treatment or interventions will be necessary.

3.8 Debriefing

Following a resuscitation at a convenient time it is extremely useful for the most senior member of the team to gather the resuscitation team together away from the clinical area to discuss events. This helps to identify positive aspects of the resuscitation and any areas of difficulty or particular problems. If there are any particular problems with equipment or systems in place for resuscitation these should be identified and flagged up for attention. Documentation of the events can be reviewed to identify any areas of weakness.

4. Principles of resuscitation techniques

4.1 Airway-opening techniques

> ***Mask inflation has no hope of success unless the airway is opened***

a. These should be performed before starting to breathe for the baby. The head should be placed gently into a neutral position (figure 2).
b. If the baby is floppy it may be necessary to use one or two fingers under each side of the lower jaw at its angle to push the jaw forwards and outwards (jaw thrust).
c. A folded towel placed under the neck and shoulders may help to maintain the neutral position.
d. Consider using a Guedel airway
e. Look, listen and feel for respiratory effort. If baby is making good respiratory effort but the chest is not moving consider suction of the nasopharynx under direct vision.

4.2 Bag and mask / mask and T-piece ventilation

a. A mask which is big enough to cover the face from the bridge of the nose to below the mouth should be chosen (figure 3.). A good seal must be obtained around the infant's face.
b. When using a mask and T-piece the oxygen flow rate should be set at 5-8 litres / minute. The first 5 inflation breaths should be given at 30cmH_2O and held for 2-3 seconds to establish a functional residual capacity. Once the chest wall is moving the inflation pressure may be reduced to 15-20 cmH_2O.
c. When using a bag and mask system, only use a 500 ml bag with a blow-off valve set at approximately 45 cmH_2O and an oxygen flow rate of 5 litres / minute. The oxygen flow rate should be increased as indicated up to a maximum of 10 litres / minute. The first 5 inflation breaths should be given slowly, compressing the bag with the fingers for 1-2 seconds.
d. Following the first 5 breaths, ventilation should occur at a rate of 30 bpm.
e. Observe the chest wall for equal movement. If there is poor inflation check that the airway is not obstructed. Re-position the head, making sure that the neck is not over-extended and consider other airway manoeuvres (2 person jaw thrust, Guedel airway etc.). If necessary perform suction under direct vision.

During prolonged mask ventilation pass a nasogastric tube to deflate the stomach. When a mask and “T” piece or bag, valve and mask system attached to a reservoir bag is used then the baby will receive the full concentration of oxygen delivered to the circuit.

There is good evidence, from trials in term infants that air should be the first choice gas in resuscitation [11]. Term infants resuscitated in air compared to 100% oxygen have decreased risk of mortality [11], higher Apgar scores, shorter time to first cry and lower $PaCO_2$ at 30 minutes of age [12,13]. In preterm infants excessive exposure to oxygen may be harmful and in particular put the infant at increased risk of ROP or other complications related to oxygen exposure. Therefore where a gas blender is available commence resuscitation with air and assess response. Aim for minimal FiO_2 .

4.3 Suction

a. Use a laryngoscope to look into the airway
b. Use a 10fg (black) suction catheter or a baby Yankauer sucker or where there is meconium and use a laryngoscope to look into the airway.
c. The pressure should not exceed 100mmHg (13.3KpA, 4”Hg).
d. Beware inserting the catheter too far and producing reflex vagal bradycardia.

4.4 Endotracheal intubation and IPPV

Equipment:-

a. A size 3 ET tube should be used for a a baby ≥32 weeks gestation, and a 2.5 ET tube for babies<32 weeks gestation.
b. A straight bladed laryngoscope
c. Bag and valve system, T-piece attatched to pressure manometer on resuscitaire to attatch to ETT. The gas flow to the system should be set at 4-8 litres / min. Increase the flow if adequate peak inspiratory pressure cannot be obtained.
d. Suction

Procedure:-

- Hold the laryngoscope in the left hand and insert into the right hand corner of the baby's mouth so that the tip of the blade lies in the oesophagus.
- Use the laryngoscope blade to sweep the tongue across to the midline.
- Gently lift the laryngoscope forwards and upwards until the larynx and vocal cords come into view. Cricoid pressure either by an assistant or by using the little finger of the left hand may be helpful.
- Hold the ETT with the right hand and gently insert into the right hand corner of the baby's mouth. Make sure not to obscure the view of the vocal cords.
- Advance the tip of the ETT through the vocal cords for 1-2 cm. Some ETT have a black marker to make identification of this distance easier. The approximate length of the ETT at the lips for infants of 1, 2 and 3kg respectively is 6.5, 7.5 and 9cm.
- Remove the laryngoscope. Attatch ETT to either a T-piece and pressure manometer system or to a bag and valve system.
- Following intubation the first 5 inflation breaths should be held for 2 seconds to establish a functional residual capacity. The infant should then be ventilated at a rate of 30 breaths/ minute.
- In rare situations it may be necessary to use high pressures to 'open' the chest. Check the peak inspiratory pressure on the pressure manometer and increase to up to 40cm H_2O in steps of 30cm, 35cm, 40cm, trialing each for 30 seconds.
- Observe chest movement and auscultate over both axillae and over the stomach to assess the correct position of the tube.
- Fixate the ETT.

Important points:-

- No longer than 30 seconds should be spent in trying to intubate the infant before recommencing bag and mask or mask and T-piece IPPV, for a minimum of 1 minute.
- Never attatch the baby directly to either the wall oxygen supply or any supply of oxygen which is not connected to some type of pressure limit valve.

In the Nottingham neonatal units and labour suites such oxygen is always attatched to red tubing. **Remember never attatch the baby directly to red oxygen tubing without placing a pressure limiting device within the circuit.**

4.5 External cardiac compressions

External cardiac compressions should be started if the heart rate is < 60 / minute but only if there has been adequate lung inflation. During external cardiac compressions the relaxation phase is very important as this is the period during which blood can flow into the heart. The inspiratory breath should only start after the compression. The quality of the compressions is vital and the rate and ratio are less important.

There are two techniques:-

- The chest is encircled with both hands so that the fingers lie behind the baby and the thumbs are opposed over the sternum (figure 4), or:-
- Two fingers are used over the sternum (figure 4).

The thumbs or fingers should be positioned 1 cm. below the inter-nipple line. They should be compressed to a depth of 1.5 to 2 cm. at a rate of 120/minute and a ratio of 3 compressions to 1 ventilation. External cardiac compressions should continue until the heart rate is >80bpm and increasing.

> ***In the infant receiving IPPV whose heart rate continues to fall the most likely cause is inadequate ventilation.***

4.6 Umbilical venous catheterisation

Equipment:-
a. Alcohol swabs
b. Umbilical tape
c. Scalpel
d 5ml syringe containing 0.9% saline
e. Size 5 or 6 UVC
f. 3 way tap

Procedure:-
a. Attatch the syringe and 3 way tap to the catheter.
b. Flush the catheter with saline.
c. Loosely tie the umbilical tape around the cord.
d. Clean the cord with the alcohol swab.
e. Cut the cord to a length of 1-3 cm.
f. Identify the umbilical vein and insert catheter. Advance to approximately 5-6 cm. Confirm that blood can be easily aspirated.
g. If the UVC fails to advance, apply traction to the cord.
h. Tighten umbilical tape to secure the catheter.

4.7 Intraosseous access

This should only be used in extreme circumstances when attempts at UVC insertion have failed. There is no place for Intracardiac injection.

4.7.1 Equipment:-

a. Alchol swabs
b. An 18fg intraosseous needle with trocar
c. 5ml syringe

4.7.2 Procedure:-

a. Identify insertion site. Ideally use the anterior surface of the tibia 1-2cm below the tibial tuberosity. Alternatively use the anterolateral surface of the femur 2-3cm above the lateral condyle.
b. Clean the skin.
c. Insert the needle at 90^{o} to the skin.
d. Advance the needle until a “give” is felt as the cortex is penetrated.
e. Remove trochar, attach 5 ml syringe and aspirate to confirm position. This bone marrow can be used to obtain a blood gas, FBC and blood sugar.
f. Give drugs as bolus injections. If the infant requires volume expanders these must be pushed in via a syringe as fluid will not flow in freely via an IO needle.

5. Availability and Provision of Equipment

On the labour wards and in Obstetric theatres, there are neonatal resuscitation trolleys, which are checked on a daily basis. There is a check list on each trolley (Appendix 4) which staff use to ensure the agreed equipment is present. There is a book attached to each trolley which is signed off and dated when the check is complete. Any faulty equipment is reported to MESU by clinical staff and is either repaired in MESU or replaced.

The resuscitaires on the labour wards and in Obstetric theatres are checked on a daily basis and recorded on the daily check list. It is the responsibility of the midwife caring/admitting a woman to labour suite to ensure that there is a resuscitaire in the room that is checked and fit for use. The neonatal staff member who is called to attend the delivery is also responsible for systematically checking the resuscitaire and its equipment unless there is not time.

The neonatal unit have a supply of resuscitation equipment available to replenish stock following resuscitation.

The Neonatal resuscitation trolleys feature on the Family Health Asset Register which is reviewed annually at the Directorate meeting, as part of the NUH Capital Bids Process.

6. Audit Points

Number of term infants requiring mask ventilation, intubation and drugs.
Problems with equipment during resuscitation
Number of staff trained on NLS courses

7. Allied Guidelines

Neonatal Guideline A2	Indications for calling a neonatal team to delivery suite
Neonatal Guideline A8	Early Care Guideline

8. Staff Training

Staff training will be provided training on neonatal resuscitation in line with the Nottingham University Hospitals Maternity Services Training Needs Analysis.

9. Monitoring Plan

The resuscitation at birth guideline will be monitored in conjunction with the NUH Maternity Services Clinical and Operational Monitoring Plan.

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Appendix 1

Summary of Resuscitation Procedure

Dry the baby, remove any wet cloth and cover (term babies)
Put baby directly into plastic bag without drying (preterm babies)

Initial Assessment
Start the clock
Assess COLOUR, TONE, BREATHING, HEART RATE

If not breathing …

Control the airway
Head in a neutral position

Support the breathing
If not breathing – *FIVE INFLATION BREATHS (each 2-3 seconds duration)*
Confirm a response:- increase in HEART RATE or visible CHEST MOVEMENT

If there is no response
Double check head position and apply JAW THRUST
5 inflation breaths
Confirm a response:- increase in HEART RATE or visible CHEST MOVEMENT

If there is still no response
a.) use a second person (if available) to help with airway control and repeat inflation breaths
b.) inspect the oropharynx under direct vision (is suction needed?) and repeat inflation breaths
c.) insert an oropharyngeal (Guedal) airway and repeat inflation breaths

Consider intubation
Confirm a response:- increase in HEART RATE or visible CHEST MOVEMENT

When the chest is moving
Continue the ventilation breaths if no spontaneous breathing

Check the heart rate
If the heart rate is not detectable or very slow (less than around 60 bpm) and NOT increasing

Start chest compressions
First confirm chest movement – if chest not moving return to airway
3 chest compressions to 1 breath for 30 seconds

Reassess heart rate
If Improving – stop chest compressions, continue ventilation if not breathing
If heart rate still very slow, continue ventilation and chest compressions consider venous access and drugs at this stage

At all stages, ask … Do you need help?

In the presence of meconium remember:

Screaming babies:- have an open airway
Floppy babies:- have a look

Appendix 2

Policy statement on resuscitation

There are two situations where a decision may be reached not to resuscitate a baby on the neonatal unit or on the labour suite.

The first of these is when a baby is dying on the neonatal unit, and this very important area of our practice is described in detail in the Policy Statement on 'The Withdrawal of Care' (Guideline A11). Clearly, a baby will not be resuscitated when he or she is dying, and the stages of management are described there.

The second situation arises at the time of birth, with babies whose gestational age is such that they are so premature that the baby will not be able to survive out of the womb.

When a mother is likely to deliver prematurely so that the baby is at or before the limits of viability, the obstetric / midwifery team inform the neonatal staff. A member of the team experienced in neonatology, i.e. the middle grade staff or consultant, goes to see the mother and father. Having gathered together all the relevant information about the baby's true gestational age, the doctor talks with the parents about the survival of babies at that gestational age, or the lack of survival at that age (figure 5). The parents' feelings and responses to that information are fully appreciated.

At the delivery an experienced doctor is present as well as the neonatal SHO / ANNP. At the moment of birth the baby is assessed in regard to size, gestational characteristics including fusion of the eyelids, bruising (which is known to be a critical determinant of outcome), and Apgar score (particularly in relation to any breathing movements).

Babies who are pre-viable by all these criteria are likely to be 23 weeks of gestation or less, although some may be 24 week babies. It must be emphasised that the gestational age is often not precisely known and all the factors listed above must be taken into account. (It would be entirely wrong to have a policy dependent only on a presumed gestational age).

Usually, the pre-viable baby will be white, flaccid and not making any breathing movements. In this case the parents, who will have been over all the facts with the neonatal doctor, will usually want to hold the baby. If they do not wish to do this, the neonatal doctors will discuss with the midwives the most appropriate place to care for the baby. This may be on labour suite or on the neonatal unit.

If the baby is clearly making efforts to establish respiration this will be supported with endotracheal positive pressure ventilation. Respiratory support with ventilation / oxygenation in a viable baby will always result in establishment of a good heart rate. Extraordinary measures, e.g. cardiac massage and adrenaline, are not used at extreme gestations (below 25 weeks).

If an SHO / ANNP is called unexpectedly to such a delivery and if in any doubt about the viability of the baby, then he / she will always initiate resuscitation until the arrival of an experienced neonatologist.

Full details of all the other aspects of the management of the dying baby and the stillborn baby are given in Guideline A11 and the labour suite stillborn policy.

Ref: A useful discussion of the issues is to be found in:
Lantos JD et al (1994) Witholding and withdrawing life sustaining treatment in neonatal intensive care: issues for the 1990s. Arch Dis Childh, 71:F218-F223.
Rennie JM (1996) Perinatal management at the lower margin of viability. Arch Dis Childh, 74:F219-F220.

DAC/SJT/May 1995 (Updated SLW/SJT November 1996)

Appendix 3

Resuscitation drug doses in ml.

APPROX GESTATION	**23**	**27**	**30**	**33**	**35**	**37**	**39**	**42**
WEIGHT (kg)	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**
Adrenaline (ml of 1:10,000) IV		0.1	0.15	0.2	0.25	0.3	0.35	0.4
Adrenaline (ml of 1:10,000) ETT		0.2	0.3	0.4	0.5	0.6	0.7	0.8
Sodium Bicarbonate (mls of 4.2%) IV		2	3	4	5	6	7	8
Neonatal naloxone (mls of diluted solution* 20micrograms/ml) IM / IV		0.5	0.75	1.0	1.25	1.5	1.75	2.0
Normal Saline (mls) IV		10	15	20	25	30	35	40
Glucose 10% (mls of 10%) IV / IO		2.5	3.75	5	6.25	7.5	8.75	10

Notes:-
* Dilute 1ml (400micrograms) of naloxone to 20ml with sodium chloride 0.9% to give a concentration of 20micrograms/ml. Mix well.
IV =Intravenous via UVC
ETT = Endotracheal tube
Intravenous access should always be used in preference to endotracheal access

Et tube size

i) Cut ET tube to size indicated below in column 2.
ii) Column 3 gives approximate length of ET tube at lips

Weight (g)	Gestation	Cut length of ET tube (cm)	Length at lips (cm)	Tube size
500	24	8.0	6.0	2.5
1000	27	8.5	6.5	2.5
1500	30	9.0	7.0	2.5 / 3.0
2000	33	9.5	7.5	3.0
2500	36	10	8.0	3.0
3000	38	11	9.0	3.5
3500	40	12	10.0	3.5

Figure 1 Management of the baby with thick or particulate meconium stained liquor

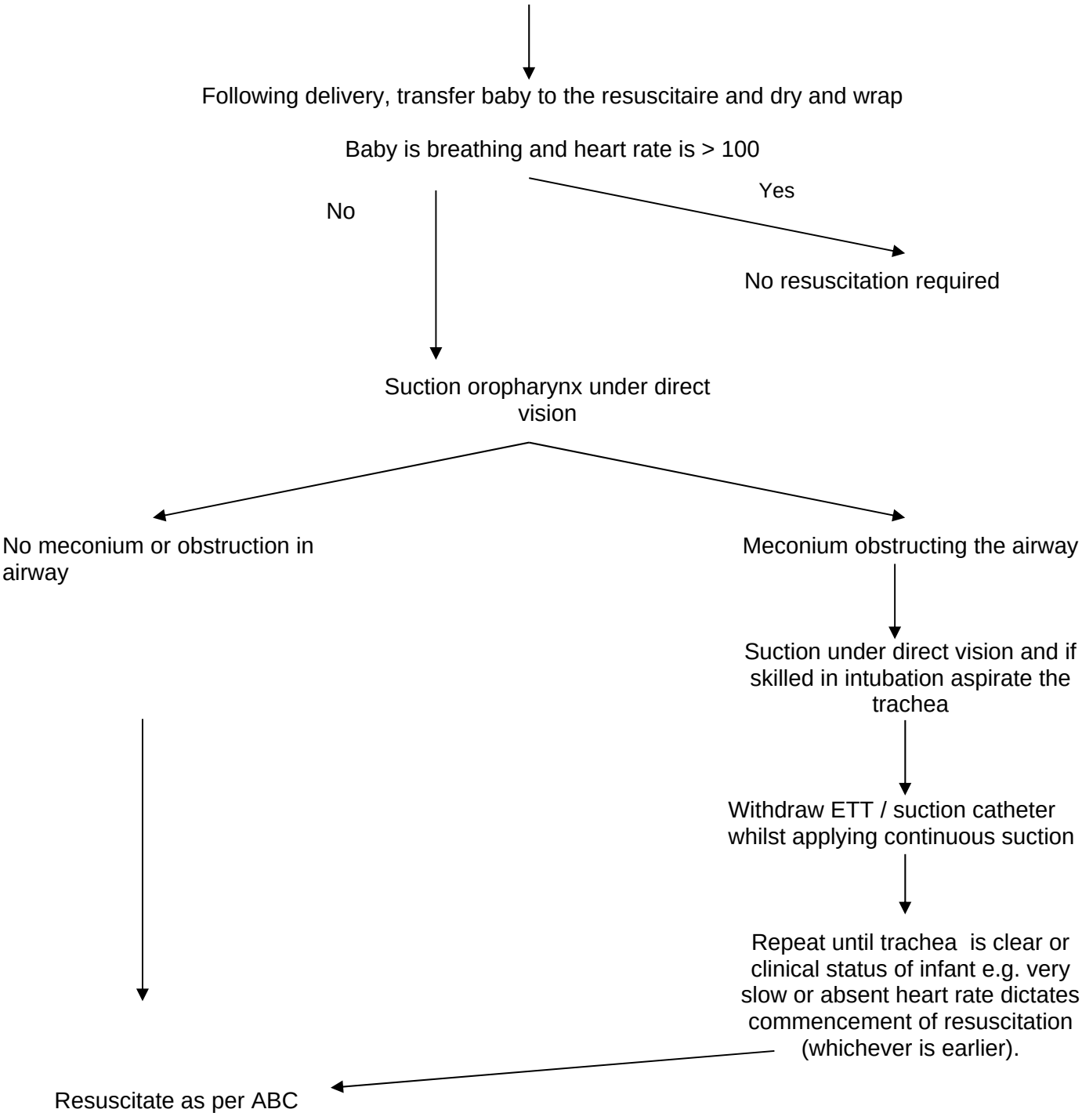
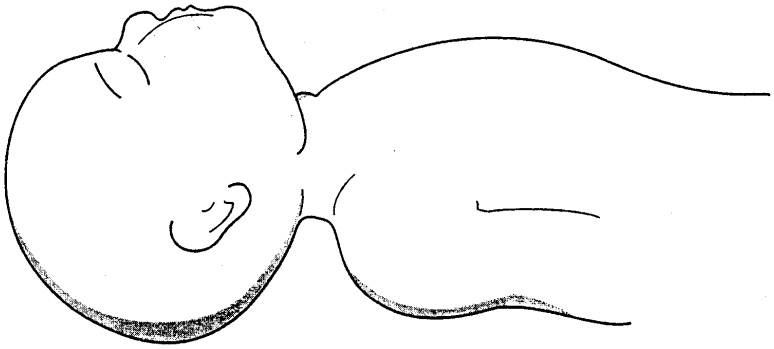


FIGURE 2

Correct position



Too flexed

Too extended

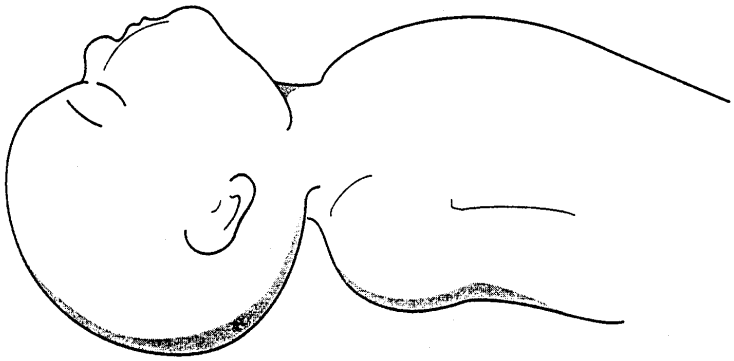


FIGURE 3

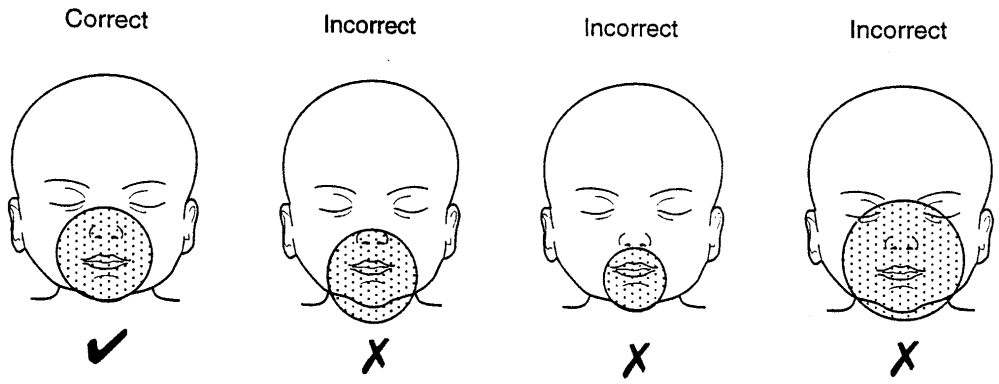
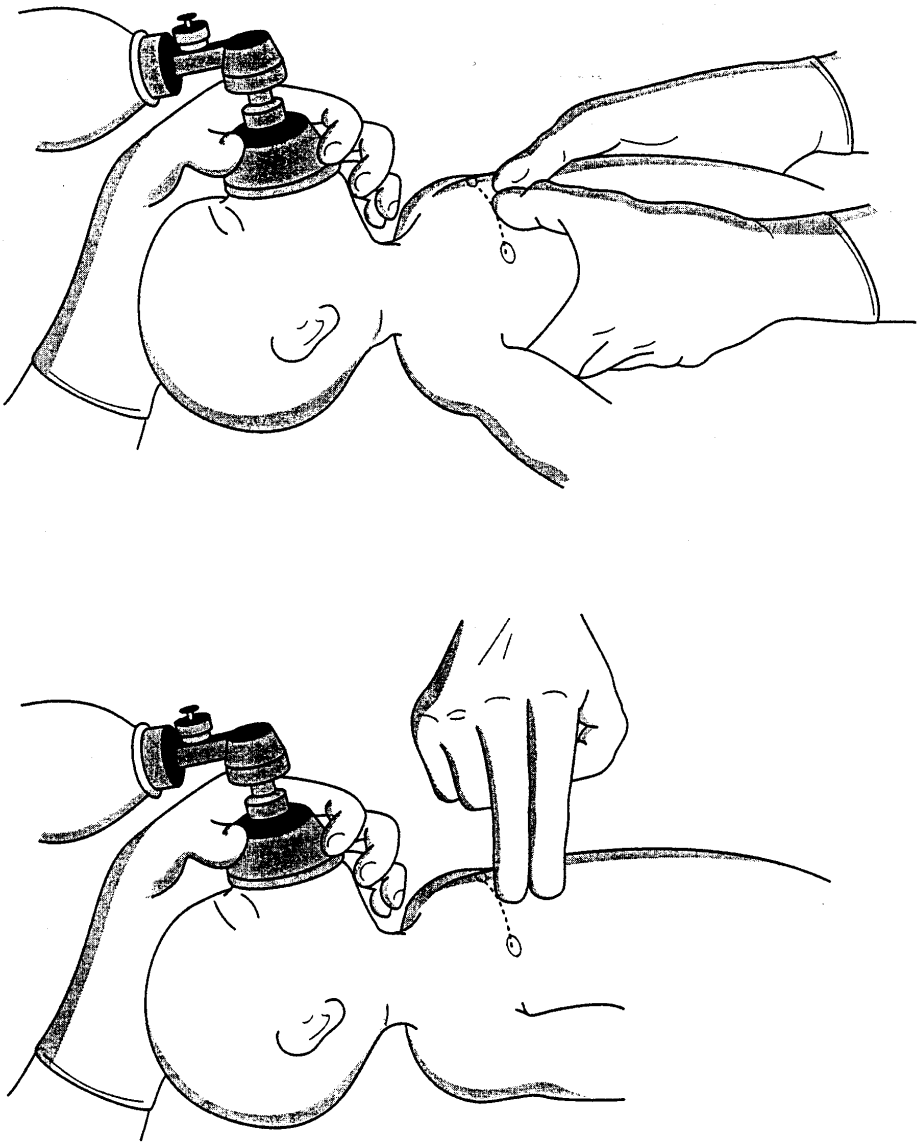


FIGURE 4



Appendix 4

Nottingham University Hospitals NHS
NHS Trust

Nottingham Neonatal Service

Resuscitation Trolley Checklist

TOP DRAWER	• Endotracheal tubes and tube holder	2.0mm	X 2
		2.5mm	X 2
		3.0mm	X 2
		3.5mm	X 2
		4.0mm	X 2
	• Endotracheal tube introducers		X 2
	• Laryngoscopes	Handle	X 1
		Long blade	X 1
		Short blade	X 1
	• Laryngeal Mask	Size 1	X 1
	• Spencer Wells Forceps		X 1
	• Hats	Very small	X 2
		Small	X 2
		Medium	X 2
		Large	X 2
	• Sterile scissors		X 2
	• Oral Airway	'0'/'00'/'000'	X 1 each
	• Universal container		X 1
MIDDLE DRAWER	• Resuscitation Drug box		X 1
	• Glucose 10%	500ml bag	X 1
	• Sodium Chloride 0.9%	500ml Bag	X 1
	• Sodium Chloride 0.9%	2ml ampoules	X 1 box
	• Sterile Water	100ml	X 1 bottle
	• Butterflies (long)	Size 23	X 4
	• Intraosseous Needles	Size 16	X 1
	• Syringes:	1ml	X 5
		2ml	X 5
		5ml	X 5
		10ml	X 3
		20ml	X 2
		50ml	X 2
	• Pump Extension Tubing	200cm	X 2
		Y Connector	X 2
	• Assorted Needles		
	• Alcohol Wipes		X 10
	• 3-way taps		X 2
BOTTOM DRAWER	• Neopuff & Tubing		X 1
	• Laerdal resuscitator and oxygen reservoir		X 1
	• Infant face masks:	Small (00)	X 1
		Medium (01)	X 1
		Large (02)	x 1
	• O2 tubing		X 1
	• Suction Tubing		X 1
	• Yankeur Suction catheter		X 2
	• Suction catheters:	Size 10	X 6
		Size 8	X 6
		Size 6	X 6
	• Nasogastric tubes	Size 5	X 1
		Size 6	X 1
		Sixe 8	X 1
	• Oral Syringes	5 ml	X 3
		10 ml	X 3
		20 ml	X 3
	• Stethoscope		X 1

Authors:
Brenda Arnold/Tracy Mackay/Catherine Vyas (Aug 1996)
Yvonne Hooton (May 2006)
Helen Rosenthal (Jan 2010)
Michelle Wilcoxson (May 2010)
Michelle Wilcoxson/Helen Rosenthal (July 2010)