NEONATAL RESUSCITATION: THE GOLDEN MINUTES OF LIFE

A Guide to Resuscitation of Newborn Infants

Adapted from Neonatal Resuscitation Program
American Academy of Pediatrics

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Preface

This handout is intended for providers involved in caring for newborn babies. This write-up is in no way a replacement for any textbook. This work is an excerpt from the 9th edition of Textbook of Neonatal Resuscitation®. The main idea is to summarize the key concepts of newborn resuscitation in a concise and presentable manner for clinicians. However, it is strongly recommended that readers refer to the main textbook for complete reference.

There are no financial benefits derived from this handout. It is distributed free of cost, and no charges should be claimed for distributing it further.

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Learning Format (4-step approach)*

At Home: (THEORY session)

Step 1:

Read this handout and refer to the NRP Textbook if available

Step 2:

Answer all questions at the end of the book (passing score is 80%, 12 out of 15)

In Hospital: (DEMO session)

Step 3:

See and practice the demonstration of the following with your instructor at your hospital:

A) Ventilation and Oximetry (with the available equipment)

B) Chest Compression and coordination with ventilation (on the manikin)

C) Endotracheal Intubation (on the head model of manikin)

Step 4:

Demonstrate the successful completion of step 3 (Skill stations/Integrated sessions)

*For resource-limited settings, skip this page if you are taking the course in the USA

Topics

1. Foundations of Neonatal Resuscitation
2. Anticipating and preparing for resuscitation
3. Initial steps of Newborn care
4. Oximetry & using supplemental oxygen
5. Ventilation
6. Chest Compression
7. Intubation
8. Medication / Vascular access
9. Post-resuscitation care
10. Beyond initial steps (special consideration)
11. Preterm infants (special needs)
12. Ethics
13. Improving Resuscitation Team Performance
14. Resuscitation outside the delivery room
15. QI to resuscitation
16. Resuscitation of NB with congenital heart disease
17. Resuscitation in the NICU

NRP Essentials

NRP Advanced

Optional

NRP Essentials

Lessons 1-5 (up to Ventilation)

NRP Advanced

Lessons 1-5, PLUS Lessons 6-12

OPTIONAL:

Lessons 13-16

1) About resuscitation - Why learn newborn resuscitation

Birth asphyxia is associated with both increased mortality and morbidity. By learning the basic skills of neonatal resuscitation, one can make a difference in changing this statistic. Key points:

- About 5% of newborns will receive positive-pressure ventilation.
- About 2% of newborns will be intubated.
- While 1 to 3 per 1,000 will receive chest compression or medications.

2) Preparing for resuscitation

Adopt a team approach. Identify risk factors (prematurity, preeclampsia, abruption, twins, macrosomia, breech, etc.)

4 questions to be asked:

1. Gestational age
2. Amniotic Fluid
3. Risk factors
4. Umbilical Cord Management Plan

4 questions before birth:

GARU

G- Gestational age
A- Amniotic fluid
R- Risk factors
U- Umbilical cord care plan

Equipment check:

Warmer, Towels, Hat, Suction, Stethoscope, PPV apparatus, Endotracheal tube, Medications, Catheters, Oxygen supply & Saturation monitor.

3) Initial steps of resuscitation

It is very important to prepare for the anticipated delivery (know the case). Gather maternal information (risk factors), check equipment (warmer, bag & mask, medication), and arrange for a team (for high-risk delivery, at least 3 members should be available).

Soon after delivery, ask these questions:

3 questions after birth:

Texas To California

T- Term
T- Tone
C- Crying

Initial questions: (term, tone, crying)

Is the baby TERM?
Does the baby have good TONE?
Is the baby BREATHING or CRYING?

Initial steps:

Initial Steps:

W- Warmth/ Temperature
D- Dry (> 32 weeks)
P- Position
S- Stimulate if needed
C- Clear secretions if needed

Provide warmth (for preterm use, a warm mattress)
Dry thoroughly (< 32 weeks, no need to dry)
Position (sniffing position)
Stimulate & clear secretions if needed

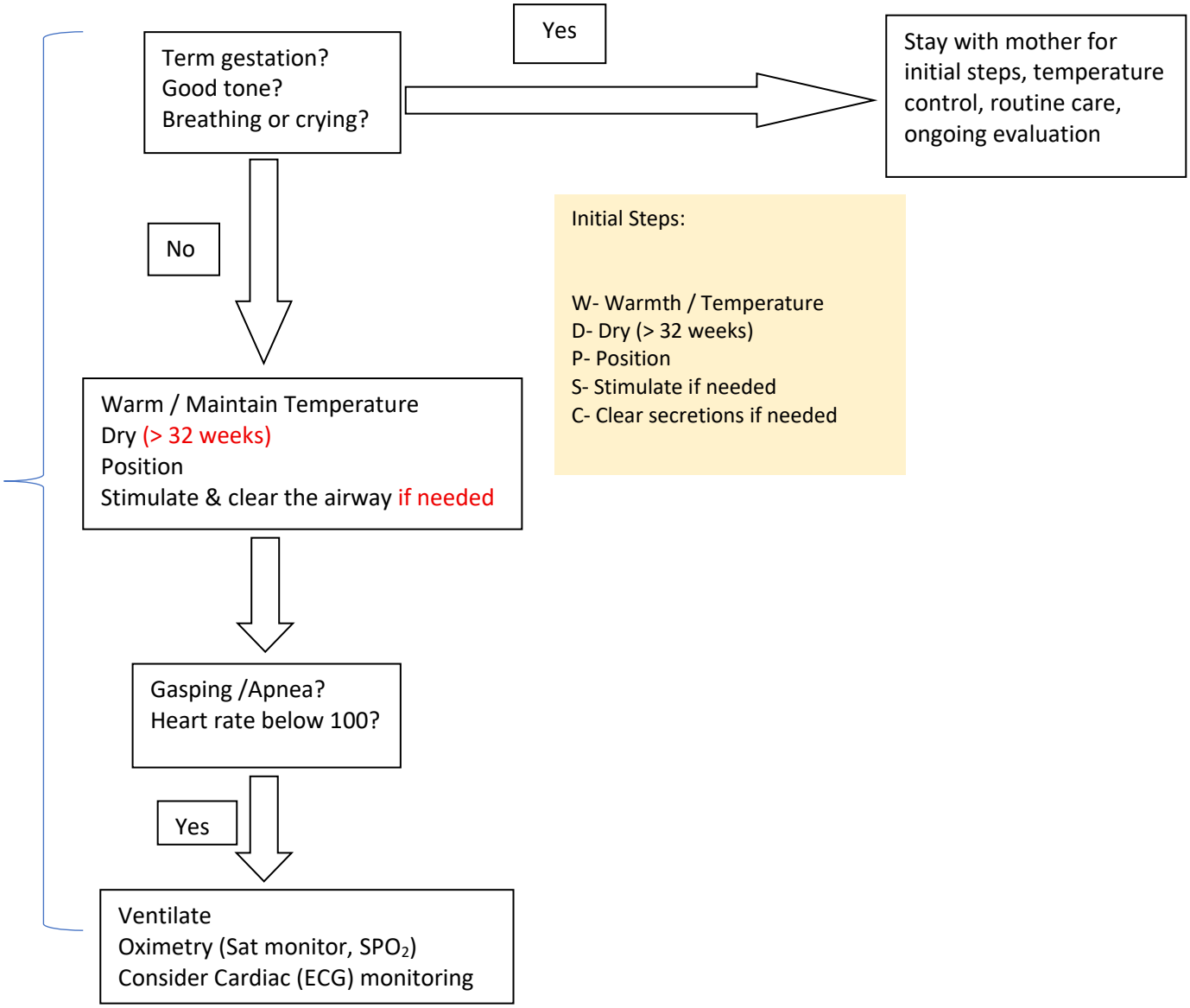
If answers are yes to initial questions (Term, Tone good, Breathing) baby should stay with mom, and initial steps should be performed at the parents' chest.

If the answers are no, then start the initial steps at the warmer bed.

Then EVALUATE:

Respiration: gasping, apnea – start ventilation (see flow diagram)
Heart rate: below 100 – start ventilation (see flow diagram)

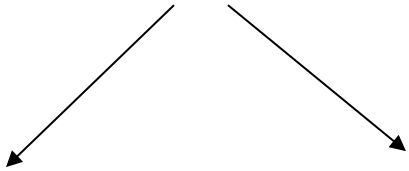
FLOW DIAGRAM



Initial steps in a delivery with a history of Meconium-stained amniotic fluid

Baby Vigorous

(Strong respiratory efforts, good muscle tone, heart rate > 100 bpm)



YES

Continue with Initial steps

NO

Suction mouth & nose

Routine intubation is not suggested

(Follow the initial steps)

Warmth:

Skin to skin with mom
Cover with a towel or blanket
Place under the Radiant warmer

Initial Steps:

W- Warmth/ Temperature
D- Dry (> 32 weeks)
P- Position
S- Stimulate if needed
C- Clear secretions if needed

Dry:

Prevent heat loss (use a towel or blankets)
Remove wet blankets

Clear airway:

Bulb suction
Catheter (French 6-10) using suction pressure of 80-100 mm of Hg
Suction mouth ***before*** nose (M before N)

4) Oximetry & Using Supplemental Oxygen

For equipment and principles of use, please refer to your hospital device. This topic will be addressed in detail in the DEMO session. Points to remember about Oxygen are:

- Use blenders (air + oxygen), flow 10 LPM
- DO NOT give supplemental O_2 based on the color of the baby (color is very subjective)
- DO NOT give O_2 to achieve higher SpO_2 readings (> 95%) in the first few minutes of life.
- Oxygen can be given as free flow by oxygen mask, tubing with cup hand, flow-inflating bag, or T-piece resuscitator
- Self-inflating bags **CANNOT** be used to give supplemental oxygen or CPAP
- Use O_2 based on guidelines (Table 1)
- Adequate ventilation should be established ***before*** using supplemental O_2.
- Start with 21% O_2 (> 35 weeks), 21-30% (<32-34 weeks), and >30% (<32 weeks), set flow at 10 L/min, then adjust it based on guidelines (Table 1)
- Stop O_2 when target sats are reached

Table 1

Target pre-ductal SPO_2 after birth (pulse Oximetry chart) in the first 10 minutes

Table 1 emphasizes the fact that it takes 10 minutes for a newborn to have saturations above 85%.

Time	**SpO_2**
2 min	65-70%
3 min	70-75%
4 min	75-80%
5 min	80-85%
10 min	**85-95%**

Target Saturations Tip:

Oxygen saturations increase by 5-10% every minute

2 min 65-70%
3 min 70-75%
4 min 75-80%
5 min 80-85%
10 min 85-95%

Initial oxygen concentration during Ventilation	
≥ 35 weeks' Gestation	21% Oxygen
32-34 weeks' Gestation	2% - 30% Oxygen
<32 weeks' Gestation	≥ 30% Oxygen

5) Ventilation

For the equipment and principles of use, please refer to your hospital device (self-inflating bag, flow-inflating bag, or T-piece resuscitator). This topic will be addressed in detail in the DEMO session.

Positive Pressure ventilation (PPV) or Bag & Mask ventilation is used when:

- The infant is in gasping or apneic
- Initial steps fail in establishing adequate respiration
- When the heart rate is below 100 bpm

Rate: Ventilation rate should be 30-60 breaths/min
Pressure: PIP should be 25-30 cmH_2O, PEEP 5 (Term infant)
PIP should be 20-25 cmH_2O, PEEP 5 (Preterm infant)

Effective ventilation should result in improvement indicated by:

- Rising heart rate
- Increasing SPO_2 (oxygen saturation)

When ventilation does not result in improvement, follow MR SOPA

M = Mask adjustment
R = Reposition
S = Suction airway
O = Open mouth
P = Pressure Increase
A = Airway alternative

When ventilation takes long time:

- Consider intubation
- Insert an orogastric tube to decompress the stomach

6) Chest Compression

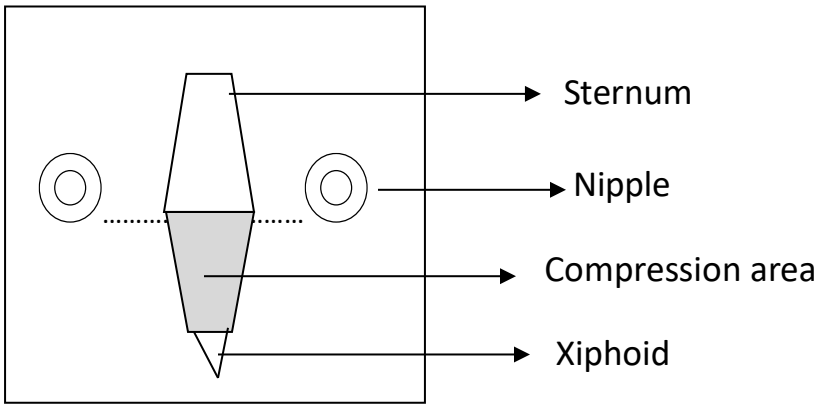
This topic will be addressed in detail in the DEMO session. The basic questions are when to start chest compression, why, what, and how.

WHEN: for heart rate below 60 bpm

WHY: to mechanically pump the blood flowing through the heart

WHAT: compress the heart against the spine, increase thoracic pressure

HOW: compressing the1/3rd of the AP diameter of the chest with two thumbs (see drawing below)

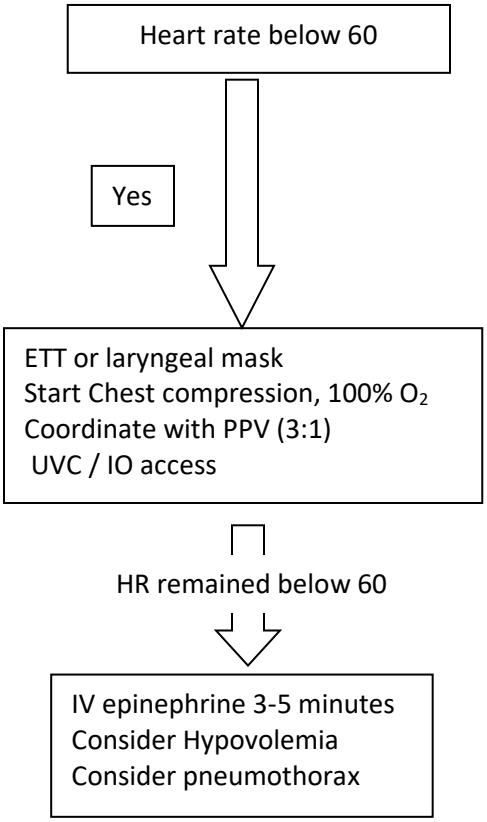


Pearls of Chest Compression:

- Coordinate chest compression with PPV
- Ratio is 3:1 (one-and-two-and-three and breathe), i.e., 90 compression and 30 breaths - each 2-second cycle
- Increase O_2 to 100% during chest compression
- Wait 60 seconds, then evaluate (see the flow diagram below)

Key points:

- When heart rate is above 60 bpm, stop compression BUT continue ventilation
- When heart rate is below 60 bpm, give IV epinephrine (place umbilical venous catheter & consider intubation if not done already)



7) Intubation

For equipment and techniques of Endotracheal (ET) intubation and use of Laryngeal Mask Airway (LMA) –if available, please refer to your hospital policies and manual. ET size and depth of insertion is based on expected weight and gestational age. Intubation should be completed in 30 secs. This topic will be addressed in detail in DEMO session.

8) Medication

Epinephrine:

Strength: 1: 10,000
Dose: Intravenous *(preferred route)*: 0.02 mg/kg = 0.2 ml/kg (0.1-0.3 ml/kg)
-use 1 ml syringe
Endotracheal: 0.1 mg/kg = 1 ml/kg (0.5-1 ml/kg) -use 5 ml syringe
Give as rapid push followed by 3 ml of normal saline flush

Volume: Normal saline or Ringer's lactate
10ml/kg, give over 5-10 minutes

Venous access – Umbilical venous catheter Insertion:

For equipment and insertion technique, please refer to your hospital policies and manual. This topic will be addressed again in the DEMO session.

9) Post-resuscitation care

Monitor respiratory efforts, oxygenation, BP, temperature and glucose.

10) Beyond initial steps (special consideration)

As stated earlier, most of the babies respond to initial steps of resuscitation. If not, then consider the following:

- Hypovolemia (give volume expanders)
- Pneumothorax (aspirate with needle)
- Airway disorders [(Choanal atresia, Robin syndrome) – use LMA]
- Diaphragmatic hernia (Intubate and place OG tube)
- Pneumonia, pleural effusion, pneumonia, pulmonary hypoplasia

11) Preterm Infants (special needs)

General resuscitation principles are not much different from the term infants. But following points should be considered:

- Ask for additional trained personnel
- Use Plastic bags and heated mattress to prevent hypothermia
- Handle gently, no rapid pushes of IVFs
- PPV inflation pressure should start with the lowest
- Use appropriate size mask, catheters and tubes

12) Ethics

- Know your regional statistics (mortality & morbidity) - that will guide to counsel parents about babies born at the limit of viability

- Know the religious and cultural background of the community

- Be supportive to the families and consider their wishes

13) Improving Resuscitation Team Performance, Resuscitation Outside the Delivery Room, and Bringing Quality Improvement to Your Resuscitation Team

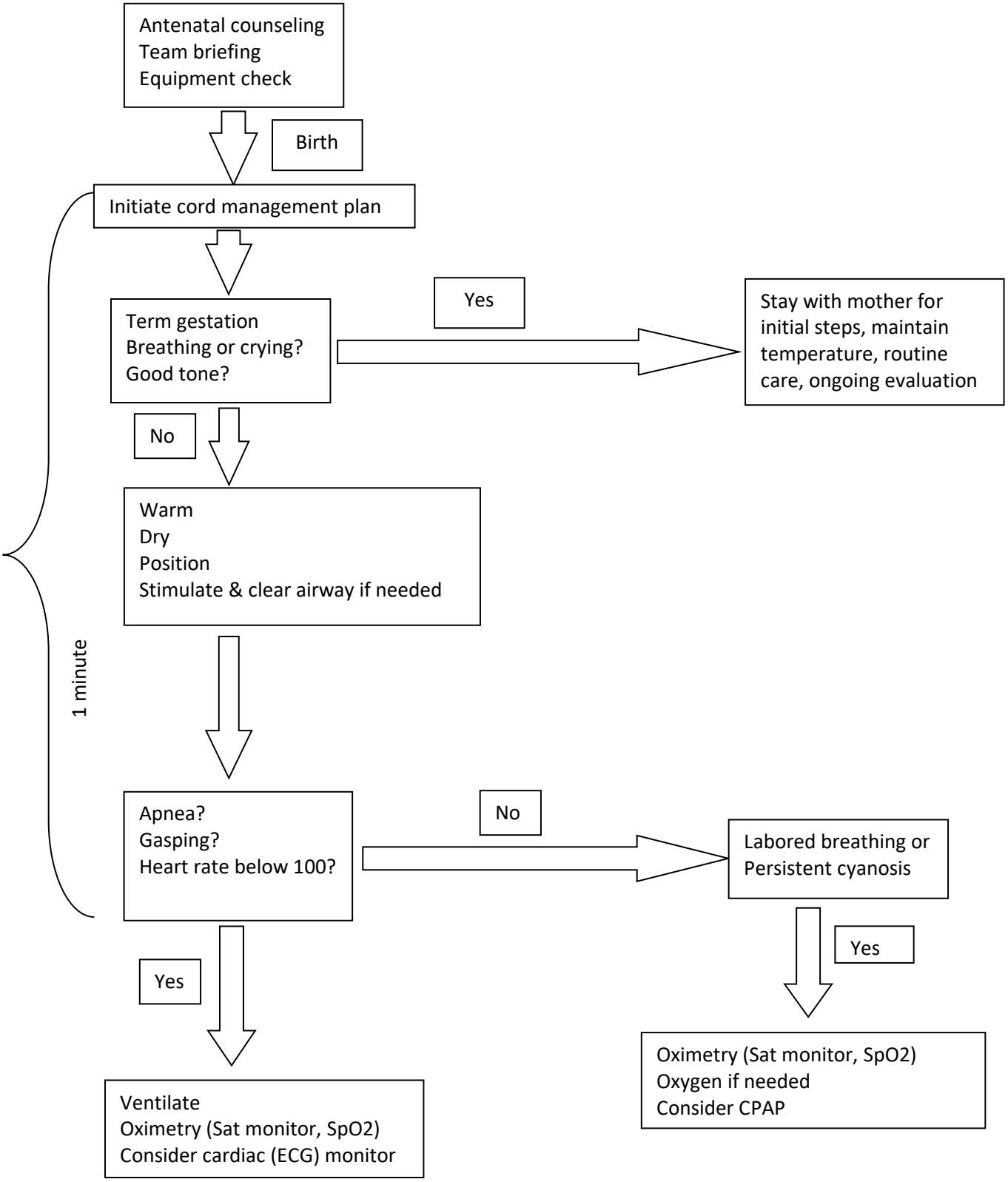
14) Resuscitation outside the delivery room

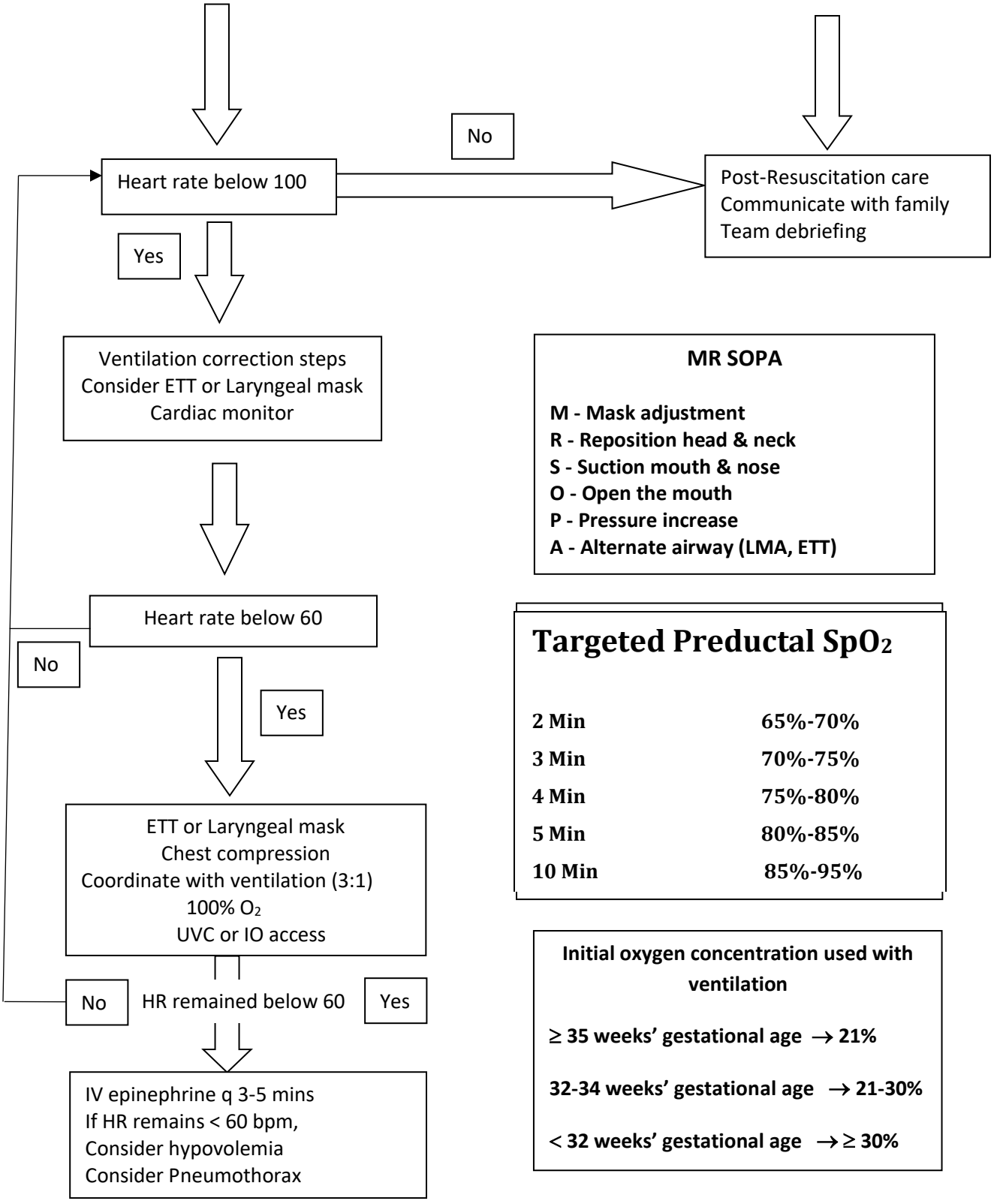
15) QI to resuscitation

16) Resuscitation of NB with congenital heart disease

17) Resuscitation in the NICU

FLOW DIAGRAM





MR SOPA

M - Mask adjustment
R - Reposition head & neck
S - Suction mouth & nose
O - Open the mouth
P - Pressure increase
A - Alternate airway (LMA, ETT)

Targeted Preductal SpO_2

2 Min	**65%-70%**
3 Min	**70%-75%**
4 Min	**75%-80%**
5 Min	**80%-85%**
10 Min	**85%-95%**

Initial oxygen concentration used with ventilation

≥ 35 weeks' gestational age → 21%

32-34 weeks' gestational age → 21-30%

< 32 weeks' gestational age → ≥ 30%

QUESTIONS

1. About _____ per 1,000 newborns will need cardiac compression or medication.
2. One minute Apgar score usually determines the need for resuscitation (True/False)
3. It is NOT suggested to intubate non-vigorous babies born with meconium-stained amniotic fluid (True/False)
4. The four questions before delivery are _____.
5. The three questions soon after birth are _____.
6. After 30 seconds of birth, if the baby is not breathing, one should intubate (True/False)
7. After 5 minutes of birth, an uncomplicated infant born at term has an Apgar score of 9/9. His oxygen saturation would be 80-85% (True/False)
8. Flow-inflating bags could be used to give free-flow oxygen (True/False)
9. The chest is not rising with ventilation using mask, one should do all EXCEPT
   A- Adjust Mask
   B- Reposition the head
   C- Suction the airway
   D- Check Oxygen source
10. When ventilation is provided for a long period, an oral airway should be inserted (True/ False)
11. Chest compression in newborns should be started for a heart rate below 80 beats/min. (True/False)
12. Endotracheal epinephrine dose is higher than intravenous epinephrine dose (True/ False).
13. During chest compression the depth should be 1/3rd of the anterior-posterior diameter of the chest (True/False)
14. The correct ratio of Chest compression to ventilation is 1:3. (True/False)
15. A baby born at 23 weeks of gestation is not viable and should NOT be resuscitated (True/ False)

ANSWERS

1. 1-3 per 1,000 will need chest compression or medications
2. False (Don't need to wait for 1 minute- vital 60 seconds are wasted)
3. True (intubation is not suggested, suction and airway, and provide routine care)
4. Gestational age, Amniotic fluid, Risk factors, Cord care plan
5. Term, Tone, Crying/breathing
6. False (Provide ventilation before intubation)
7. True (sats 80-85% by 5 minutes of life, see Table 1)
8. True (Can't use a self-inflating bag to give free-flow Oxygen)
9. D (oxygen source is not a factor in good chest rise, all others are. In MR SOPA, O is open mouth, not Oxygen)
10. False (oro-gastric tube NOT oral airway should be used to decompress or evacuate the air from the stomach)
11. 60 not 80 bpm (for HR < 100 bpm provide ventilation, and for HR > 60 stop chest compression)
12. True (IV is preferred for better absorption, dose is 0.1-0.3 ml/kg, which is lower than the 0.5-1 ml/kg used for ETT dose)
13. True (It should be 1/3rd)
14. 3:1 not 1:3 (3 compressions 1 breath; 90 compressions & 30 breaths in one minute cycle)
15. False (> 22 weeks should be resuscitated per AAP and ACOG guidelines)

If you scored 80%, you passed. Now proceed with your practical session with the instructor at the hospital.