NEONATAL RESUSCITATION: THE GOLDEN MINUTES OF LIFE

A Guide to Resuscitation of Newborn Infants

Adapted from Neonatal Resuscitation Program
American Academy of Pediatrics

2021

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Preface

This handout is presented to the providers involved in taking care of newborn babies. This write-up is no way a replacement to any textbook. This work is an excerpt from the 8th edition of Textbook of Neonatal Resuscitation®. The main idea is to summarize the concepts of newborn resuscitation and make it presentable to clinicians in net shell. However, it is strongly recommended that readers should refer to the main textbook for complete reference.

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

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Learning Format (4 step approach)*

NRP Essentials

Lessons 1-5 (up to PPV)

NRP Advanced

Lesson 1-5, PLUS Lessons 6-12

At Home: (THEORY session)

Step 1:

Read this hand-out 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) Positive pressure ventilation (PPV) and Oximetry (with the available equipments)

B) Chest Compression and co-ordination with PPV (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 USA

Topics

1. About resuscitation - Why learn newborn resuscitation
2. Preparing for resuscitation
3. Initial steps of resuscitation
4. Oximetry & using supplemental oxygen
5. Positive Pressure Ventilation (PPV)

NRP Essentials

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

NRP Advanced

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

Optional

1) About resuscitation - Why learn newborn resuscitation

Birth asphyxia is associated with both increase 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:

Good And Right Care

G- Gestational age
A- Amniotic fluid
R-Risk factors
C- 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: (3 Ts, term, tone, tantrum)

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

Initial Steps:

Warm and Dry weather Stimulate Person for Clear breaths

W- Warmth
D- Dry
S- Stimulate
P- Position head & neck
C- Clear secretions

Initial steps: (PDSPS)

Provide warmth (for preterm use warm mattress)
Dry thoroughly (< 32 week, no need to dry)
Stimulate (gentle)
Position the airway (sniffing position)
Suction if needed (mouth then nose, M comes before N)

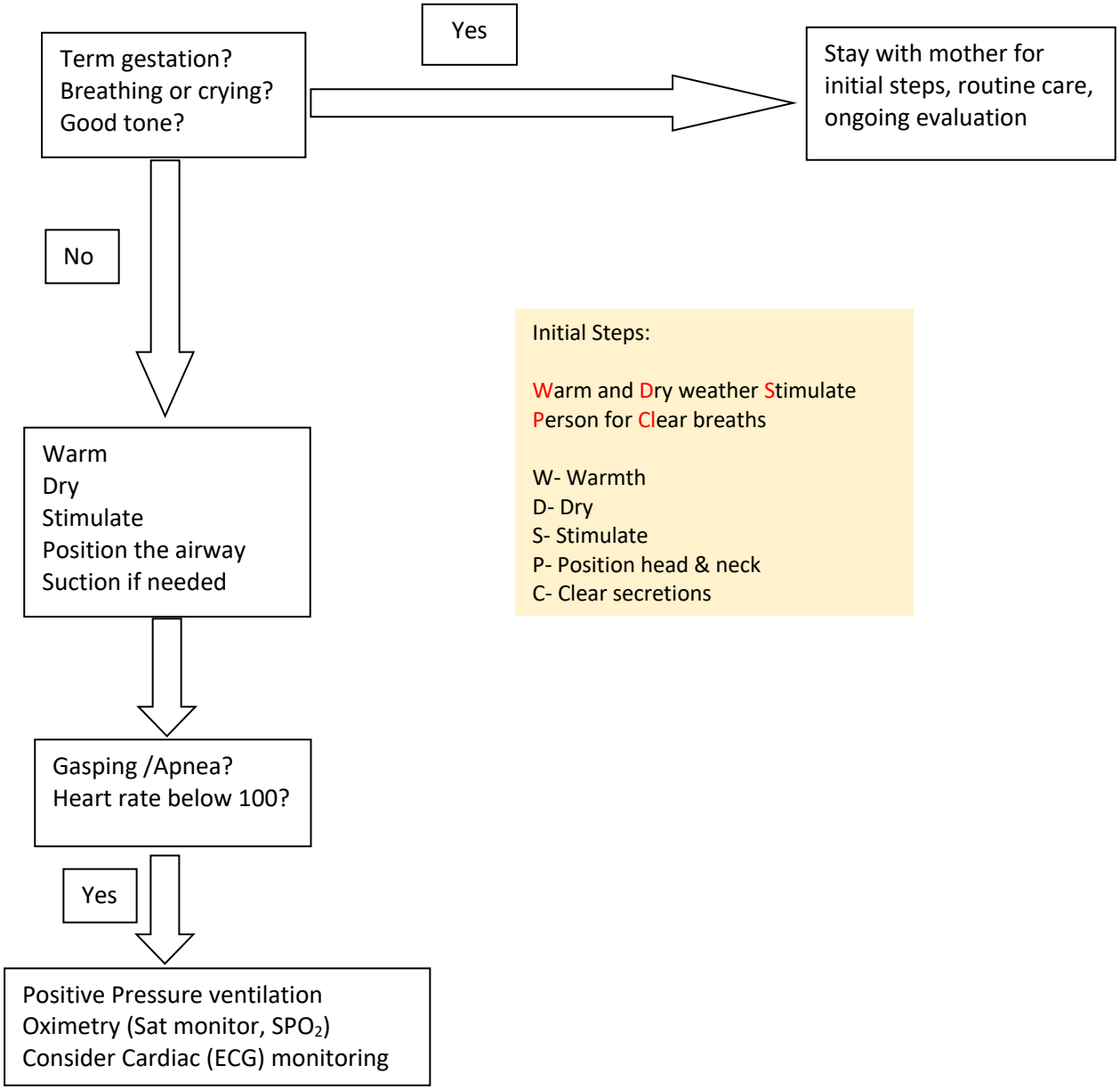
If answers are yes to initial questions (Term, Tone good, Breathing) baby should stay with mom and initial steps be performed at mom's chest.

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

Then EVALUATE:

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

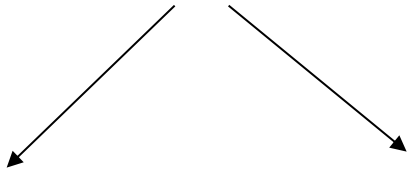
FLOW DIAGRAM



Initial steps in newborn born with history of Meconium-stained amniotic fluid

Baby Vigorous

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



YES	**NO**
Continue with Initial steps (WDSPS)	Suction mouth & nose Routine intubation is not suggested (Follow the initial steps)

Warmth:

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

Initial Steps:

Warm and Dry weather Stimulate Person for Clear breaths

W- Warmth
D- Dry
S- Stimulate
P- Position head & neck
C- Clear secretions

Dry:

Prevent heat loss (use 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 of color of the baby (color is very subjective)
- DO NOT give O_2 to achieve higher SPO_2 readings (> 95%) in 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 wks) and 21-30% (< 35 wks), set flow at 10 L/min, then adjust it based on guidelines (Table 1)
- Stop O_2 when target sats reached 85%

Table 1

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

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

(Tip: In first five minutes, for every 1 min sats go up by 5%, 1-60, 2-65, 3-70, 4-75, 5-80)

Time	**SPO_2**
1 min	60-65%
2 min	65-70%
3 min	70-75%
4 min	75-80%
5 min	80-85%
10 min	**85-95%**

Target Saturations Tip:

One minute has 60 seconds (1-60%)
Increase by 5-10 for every second.

1 min 60% -65%
2 min 65-70%
3 min 70-75%
4 min 75-80%
5 min 80-85%
10 min 85-95%

Initial oxygen concentration for PPV	
≥ 35 weeks' Gestation	21% Oxygen
<35 weeks' Gestation	21-30% Oxygen

5) Positive-Pressure 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:

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

{PPV rate should be 40-60 breath/min and pressure (PIP) should be 20-25 cmH_2O}

PPV when used adequately should result in improvement indicated by:

- Rising heart rate
- Increasing SPO_2 (oxygen saturations)

When PPV does not result in improvement do for the following: (MR SOPA)

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

When PPV is taking long:

- Consider intubation
- Insert orogastric tube to decompress stomach

6) Chest Compression

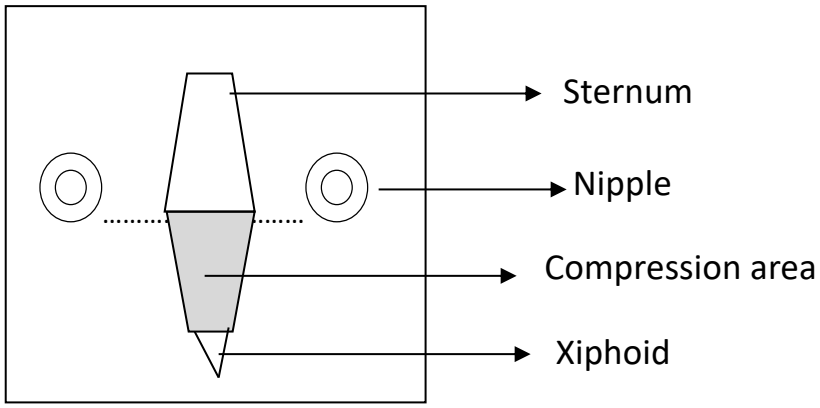
This topic will be addressed in detail in the DEMO session. The basic questions are: when to start chest compression, why, what and how.

WHEN: for heart rate below 60 bpm

WHY: to mechanically pump the blood flowing through the heart

WHAT: compress heart against the spine, increase thoracic pressure

HOW: compressing the1/3rd of the AP diameter of the chest with Two-thumbs (*preferred method*) OR Two-fingers pressing at an area above the xiphoid and a line joining the Nipples (see drawing below)

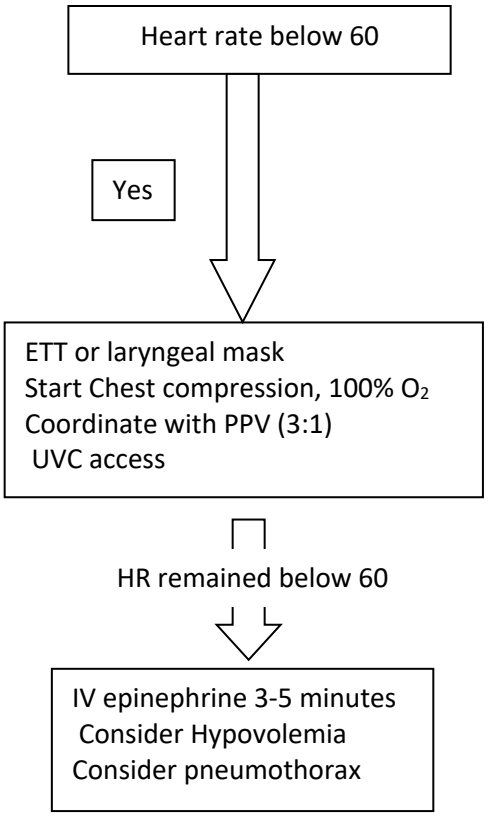


Pearls of Chest Compression:

- Co-ordinate chest compression with PPV
- Ratio is 3:1 (one-and-two-and-three and bag) i.e. 90 compression and 30 breaths in one minute
- 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 PPV
- 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

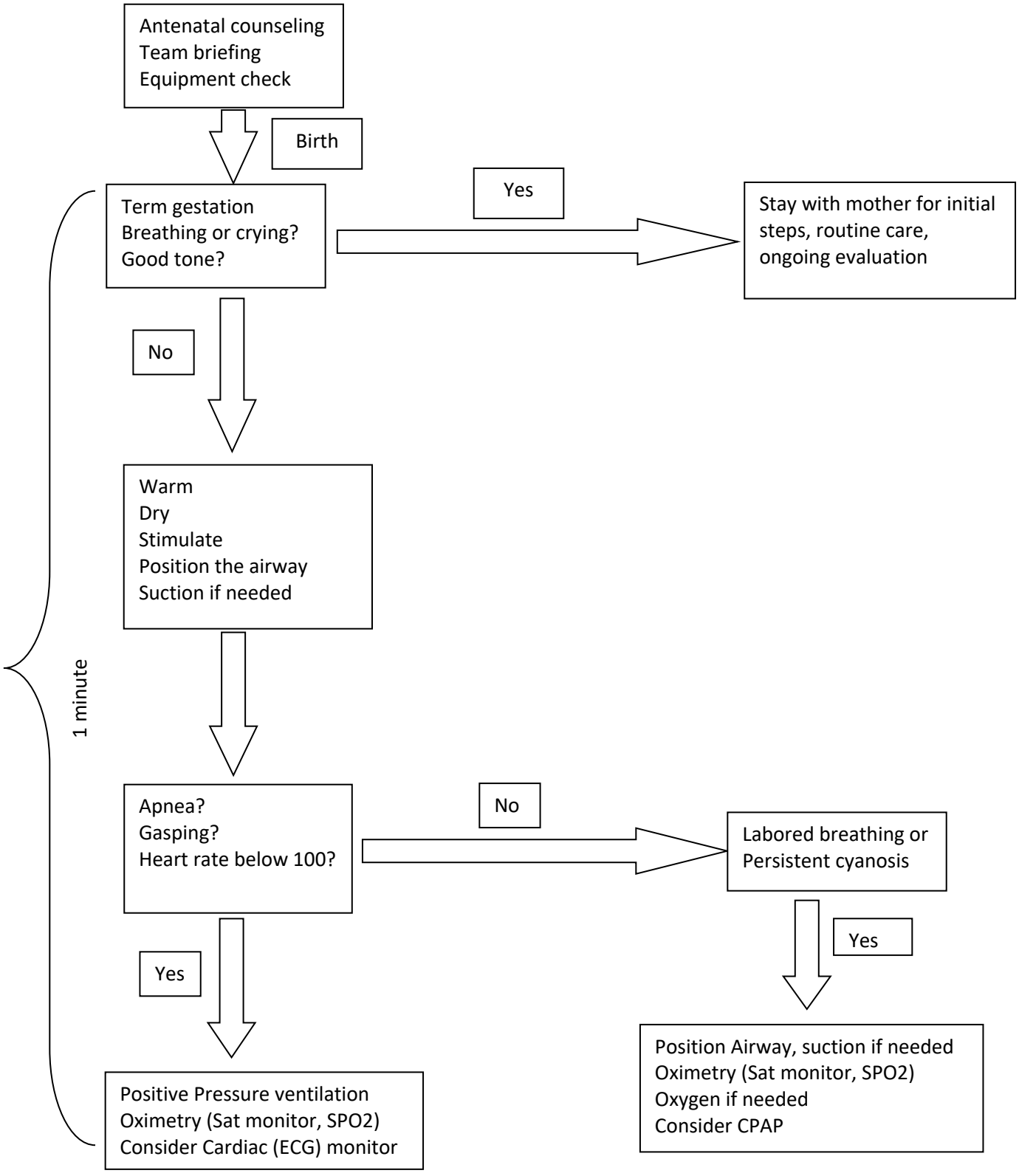
- Know the religious and cultural background of the community

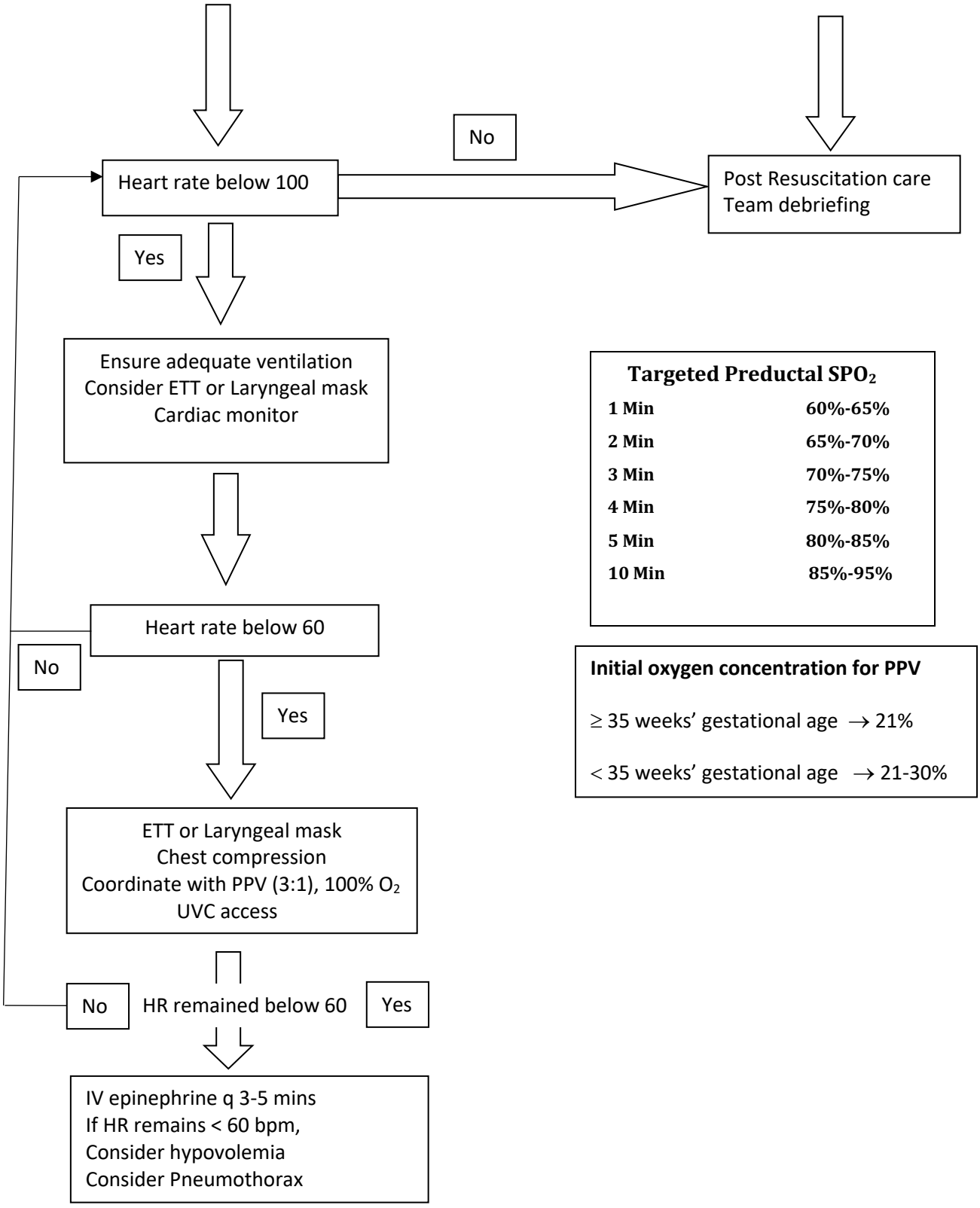
- Be supportive to the families and consider their wishes

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

- Know your setup to perform QI projects
- Extend the NRP training to other areas (ER, Home, Ambulance)
- Develop and work in a team

FLOW DIAGRAM




No
Heart rate below 100
Post Resuscitation care
Team debriefing
Yes
Ensure adequate ventilation
Consider ETT or Laryngeal mask
Cardiac monitor
Heart rate below 60
No
Yes
ETT or Laryngeal mask
Chest compression
Coordinate with PPV (3:1), 100% O2
UVC access
No
HR remained below 60
Yes
IV epinephrine q 3-5 mins
If HR remains < 60 bpm,
Consider hypovolemia
Consider Pneumothorax
Targeted Preductal SPO2
1 Min 60%-65%
2 Min 65%-70%
3 Min 70%-75%
4 Min 75%-80%
5 Min 80%-85%
10 Min 85%-95%
Initial oxygen concentration for PPV
≥ 35 weeks' gestational age → 21%
< 35 weeks' gestational age → 21-30%

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 stain 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 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 positive pressure ventilation (PPV) one should do all EXCEPT
   A- Adjust Mask
   B- Reposition the head
   C- Suction the airway
   D- Check Oxygen source
10. When PPV is provided for long period, oral airway should be inserted (True/ False)
11. Chest compression in newborns should be started for 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 PPV is 1:3. (True/False)
15. A baby born at 23 weeks 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 PPV before intubation)
7. True (sats 80-85% by 5 minutes of life, see Table 1)
8. True (Can't use 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 PPV, and for HR > 60 stop chest compression)
12. True (IV is preferred for better absorption, dose is 0.1-0.3 ml/kg that is lower than 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 wk should be resuscitated per AAP and ACOG guidelines)

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