Perinatal Asphyxia and Neonatal Resuscitation 2015

รศ.พญ.ผกาพรรณ เกียรติชูสกุล

หน่วยทารกแรกเกิด ภาควิชากุมารเวชศาสตร์

คณะแพทยศาสตร์ มหาวิทยาลัยขอนแก่น

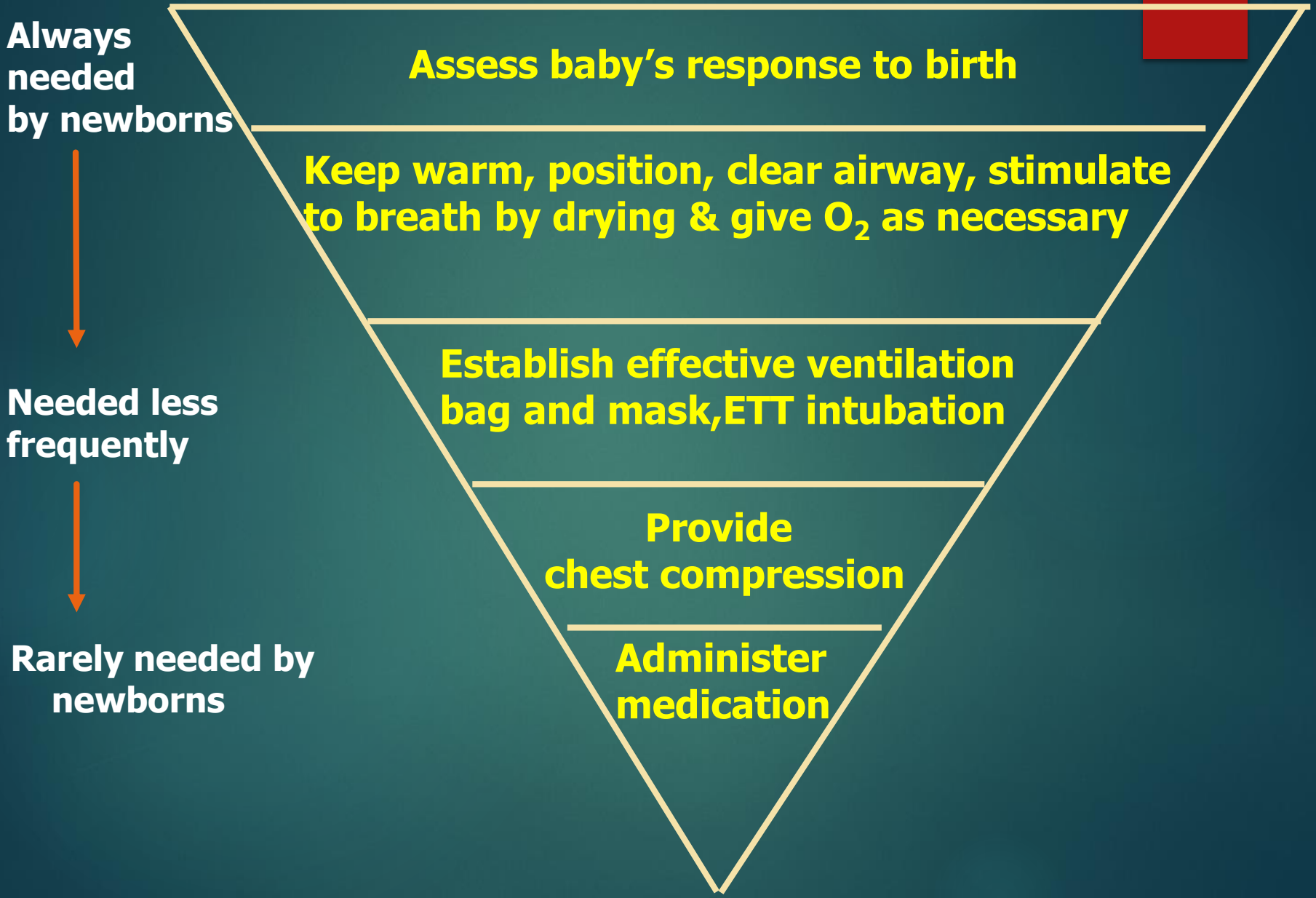
Definition

Asphyxia :

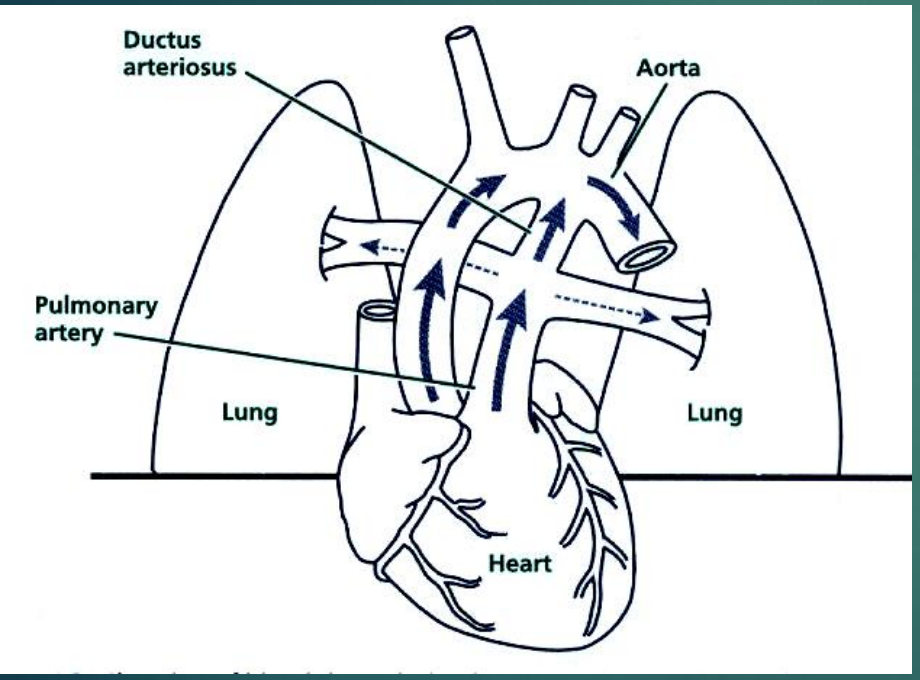
- Impairment in gas exchange
  - Deficit of oxygen in blood
  - Excess of carbon dioxide
  - Metabolic acidosis
- Need PPV after birth
- Low Apgar score

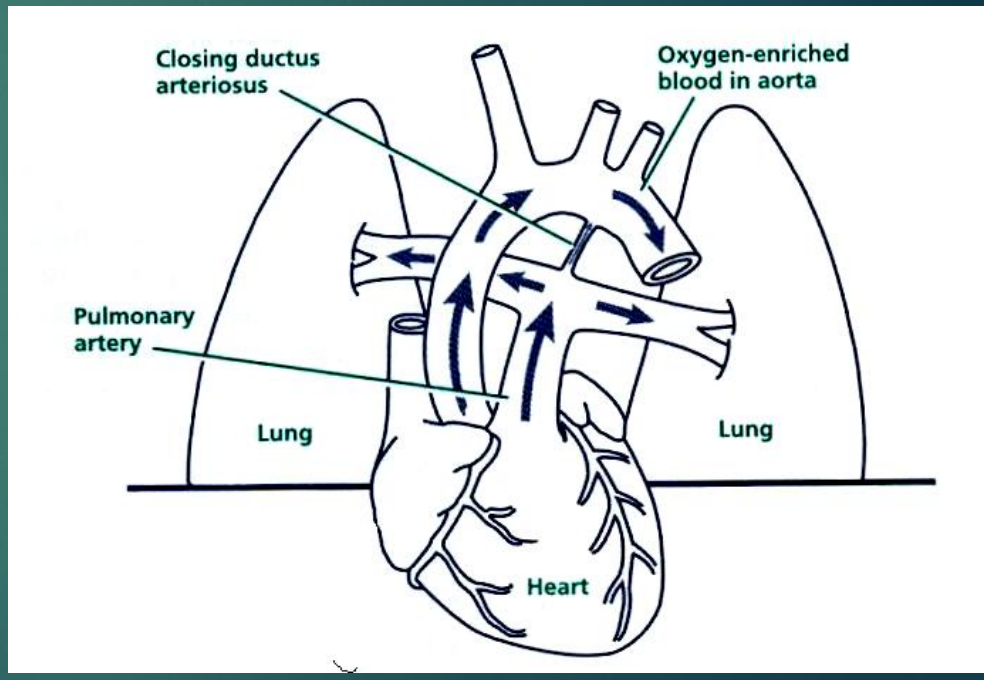
ABC of Resuscitation

- **A**irway (position and clear)
- **B**reathing (stimulate to breath)
- **C**irculation (assess heart rate and color)

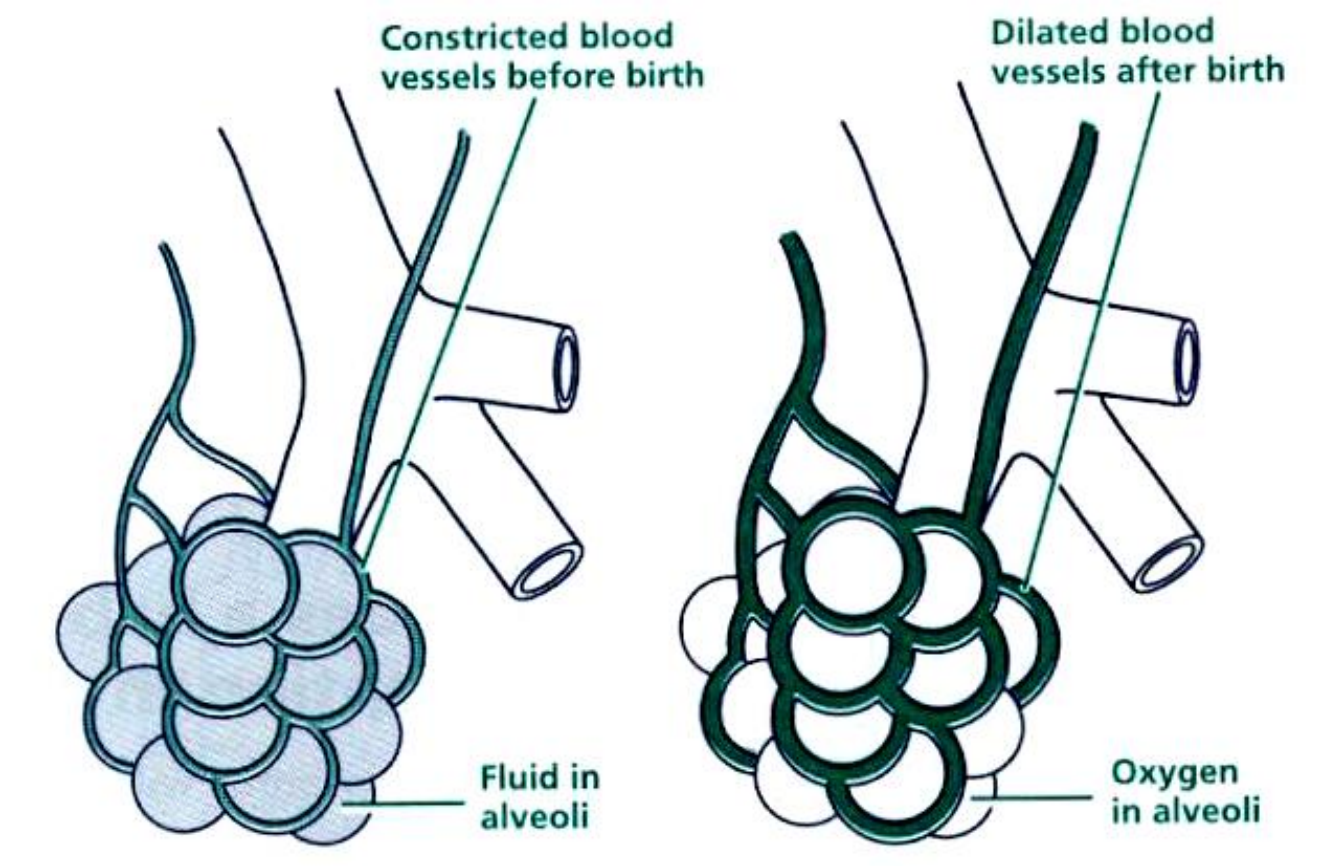

Always needed by newborns
Needed less frequently
Rarely needed by newborns
Assess baby's response to birth
Keep warm, position, clear airway, stimulate to breath by drying & give O_2 as necessary
Establish effective ventilation bag and mask,ETT intubation
Provide chest compression
Administer medication

How does a baby receive oxygen before birth?





What normally happens at birth to allow a baby to get oxygen from the lungs?

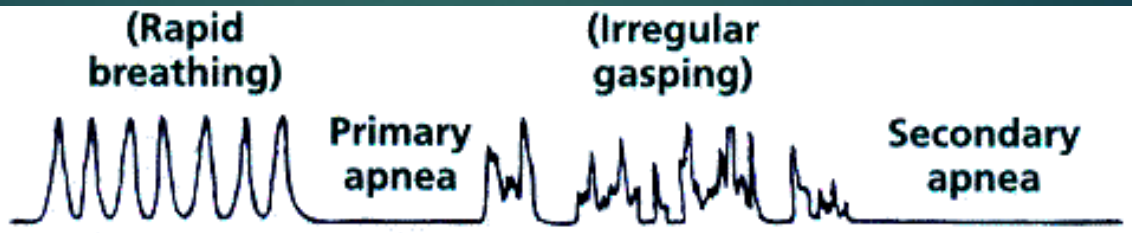


What can go wrong during transition?

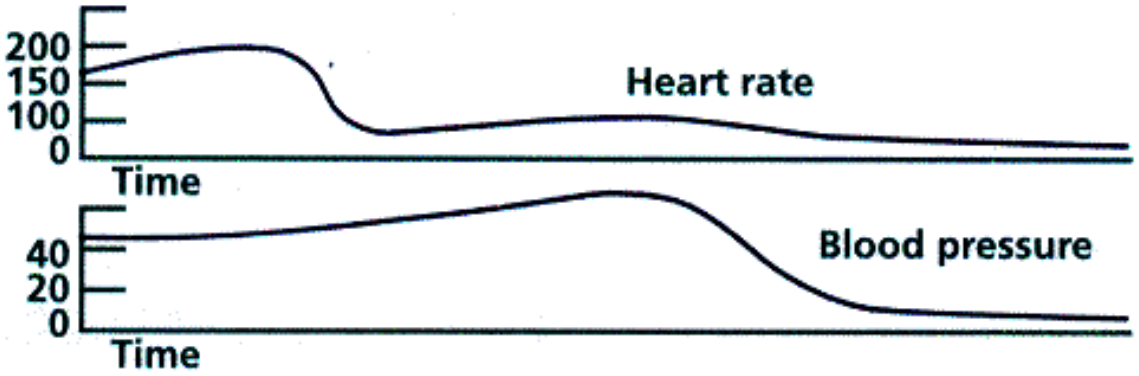
- The baby may not breath sufficiently
- Excessive blood loss may occur
- Poor cardiac contractility or bradycardia
- Lack of O_2 may result in sustained constriction of pulmonary arterioles

How does a baby respond to an interruption in normal transition?

- Redistribution of blood flow
- The baby may exhibit
  - Cyanosis
  - Bradycardia
  - Low blood pressure
  - Depression of respiratory drive
  - Poor muscle tone



Primary and secondary apnea

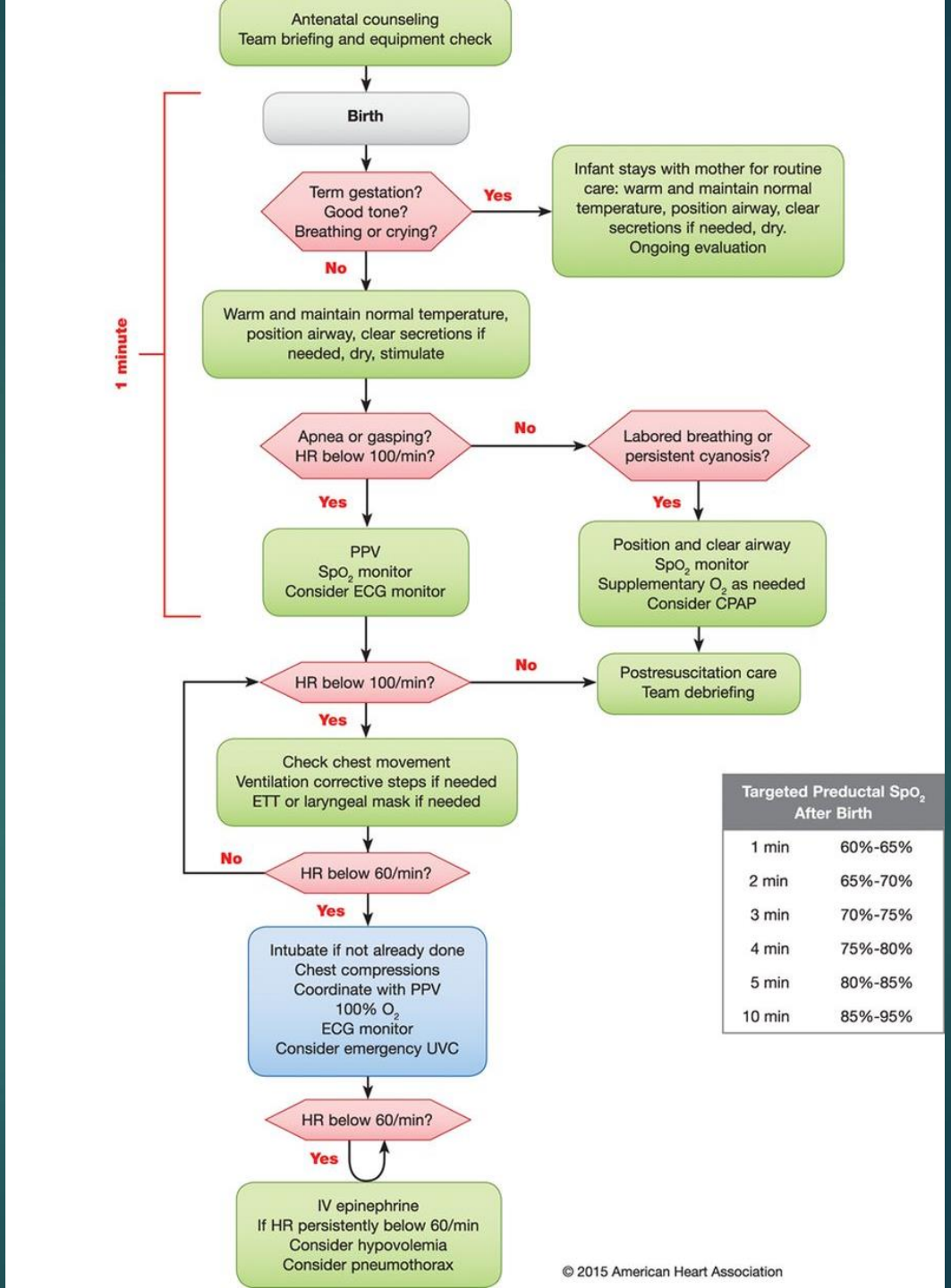


Heart rate and blood pressure changes during apnea

! If a baby does not begin breathing immediately after being stimulated, he or she is likely in secondary apnea and will require PPV

Continued stimulation will not help

2015


Antenatal counseling
Team briefing and equipment check
Birth
Term gestation?
Good tone?
Breathing or crying?
Yes
Infant stays with mother for routine care: warm and maintain normal temperature, position airway, clear secretions if needed, dry.
Ongoing evaluation
No
Warm and maintain normal temperature, position airway, clear secretions if needed, dry, stimulate
1 minute
Apnea or gasping?
HR below 100/min?
No
Labored breathing or persistent cyanosis?
Yes
Yes
PPV
SpO2 monitor
Consider ECG monitor
Position and clear airway
SpO2 monitor
Supplementary O2 as needed
Consider CPAP
HR below 100/min?
No
Postresuscitation care
Team debriefing
Yes
Check chest movement
Ventilation corrective steps if needed
ETT or laryngeal mask if needed
No
HR below 60/min?
Yes
Intubate if not already done
Chest compressions
Coordinate with PPV
100% O2
ECG monitor
Consider emergency UVC
HR below 60/min?
Yes
IV epinephrine
If HR persistently below 60/min
Consider hypovolemia
Consider pneumothorax
Targeted Preductal SpO2 After Birth
1 min 60%-65%
2 min 65%-70%
3 min 70%-75%
4 min 75%-80%
5 min 80%-85%
10 min 85%-95%
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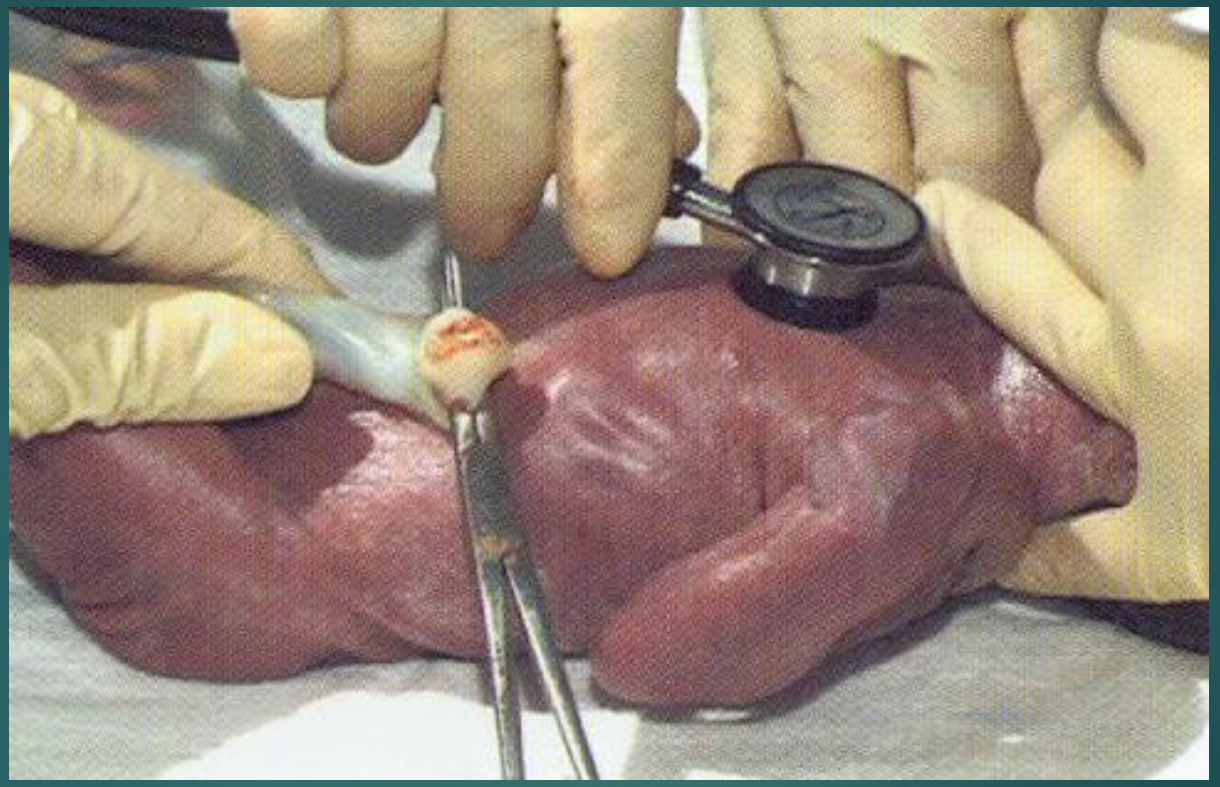
Respiration
Heart rate
Color (SpO_2)



APGAR Score

Sign	Score 0	1	2
Heart rate	Absent	<100	>100
Respiration	Absent	Irregular	Good, crying
Muscle tone	Limp	Some flexion	Active motion
Reflex	No response	Grimace	Cough,sneeze,cry
Color	Blue, pale	Acrocyanosis	Pink

Why is the Apgar score not used during resuscitation?

- Over all newborn's status
- Response to resuscitation
- Resuscitation must be initiated before the score is assigned
- Not used to determine need for resuscitation, resuscitation step, or when to use them

Anticipation of Resuscitation Need

- Careful consideration of risk factors

  more than half of NB who will need resuscitation can be identified
- Additional skilled personnel
- Prepare the necessary equipment

High-Risk Newborn

Maternal Condition

- Age < 16 , >40 years
- Personal factors : poverty, drugs
- Medical history : DM, thyroid, UTI, HT isoimmunization
- Obstetric history : past history of RDS, jaundice, bleeding, PROM, TORCH, medication

Fetal Conditions

- Multiple gestation
- IUGR
- Macrosomia
- Abnormal fetal position
- Abnormal fetal heart rate or rhythm
- Decrease activity
- Polyhydramnios , oligohydramnios

Conditions of Labor and Delivery

- Premature labor
- Prolonged labor, rapid labor
- Maternal fever
- Abnormal presentation
- Meconium stained amniotic fluid
- Prolapsed cord
- Cesarean section
- Obstetric anesthesia,analgesia

Immediate Neonatal Conditions

- Prematurity
- Low Apgar score
- Pallor,shock
- Foul smell of amniotic fluid
- Small for gestational age
- Postmaturity

คำถามสำคัญ 4 ข้อที่ต้องถามก่อนการคลอดทุกครั้ง

- อายุครรภ์
- น้ำคร่ำใสหรือไม่
- มีทารกกี่คน
- มีปัจจัยเสี่ยงเพิ่มเติมหรือไม่

Anticipation of Resuscitation Need

- Careful consideration of risk factors

  more than half of NB who will need resuscitation can be identified
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Critical Performance Steps

- **หาข้อมูลปัจจัยเสี่ยง 4 คำถามก่อนการคลอด**
- **การเตรียมทีม** :ขึ้นกับปัจจัยเสี่ยง
- **Pre-resuscitation team briefing** เน้นการทำงานเป็นทีม

  ทบทวนปัจจัยเสี่ยง
  กำหนดผู้นำทีมกู้ชีพ
  อภิปรายสถานการณ์ / กรณีที่อาจเกิดขึ้น
  แบ่งหน้าที่และความรับผิดชอบของบุคลากรในทีม
  คาดการณ์ล่วงหน้าถึงภาวะแทรกซ้อนที่อาจเกิดขึ้น
  วางแผนการแก้ไขภาวะแทรกซ้อน
- **เตรียมและตรวจสอบอุปกรณ์**ขึ้นกับปัจจัยเสี่ยงตาม checklist

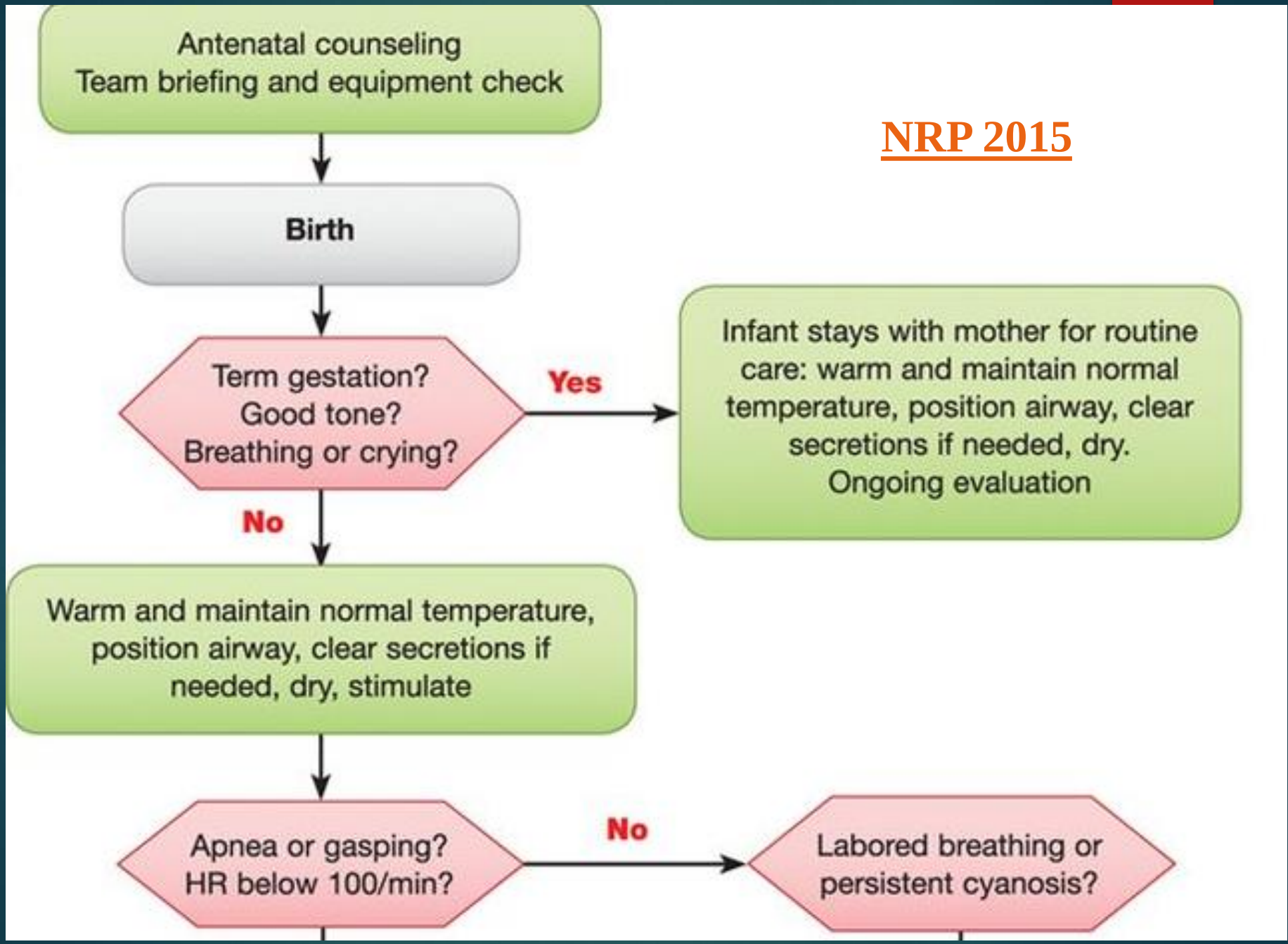
Neonatal Resuscitation Team


4 10:01 AM

Why are premature babies at higher risk?

- Lungs may be deficient in surfactant
- Susceptible for heat loss
- More likely to be born with infection
- Brain vasculature susceptible to bleeding during stress

NRP 2015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Ongoing evaluation
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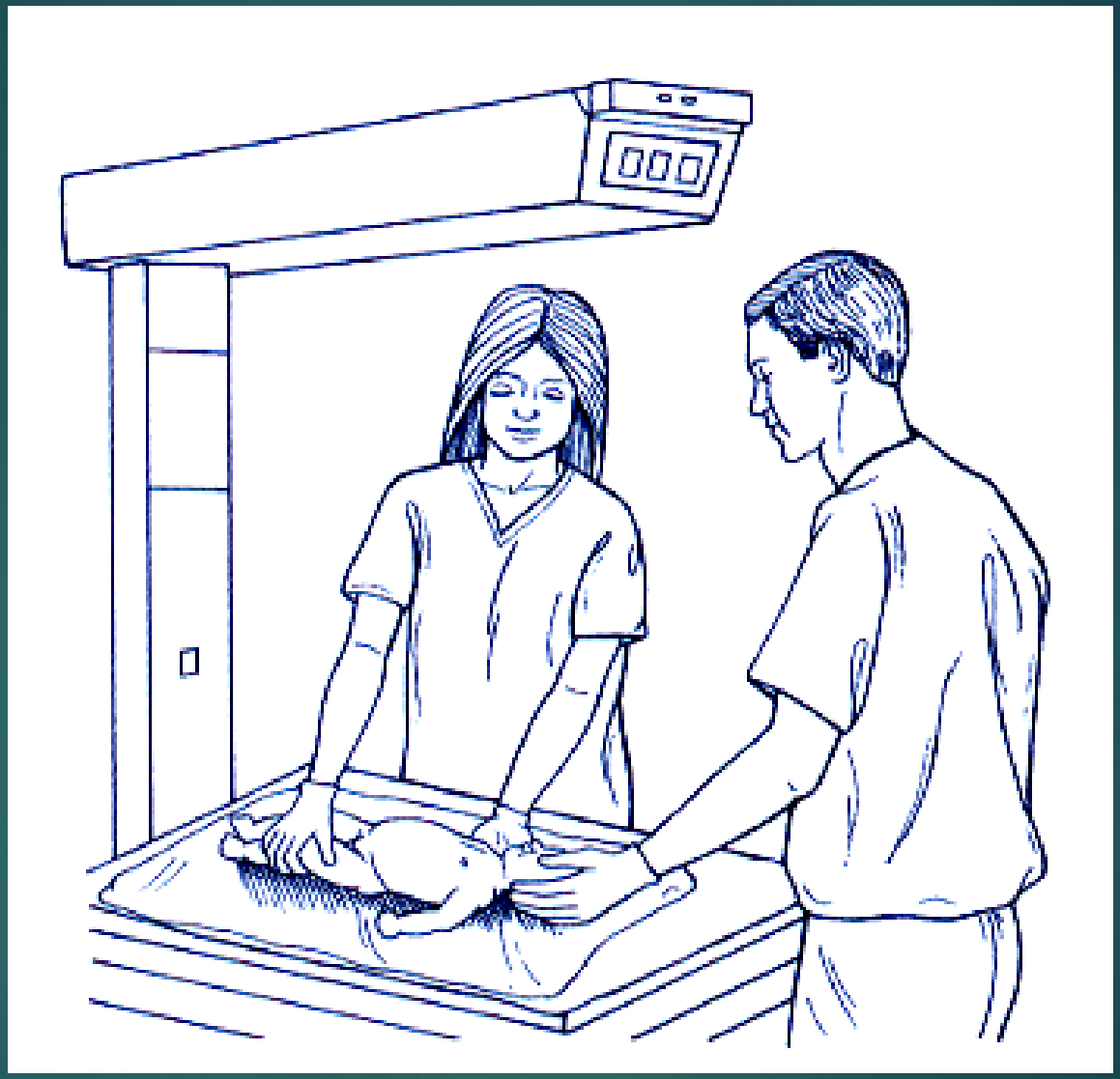
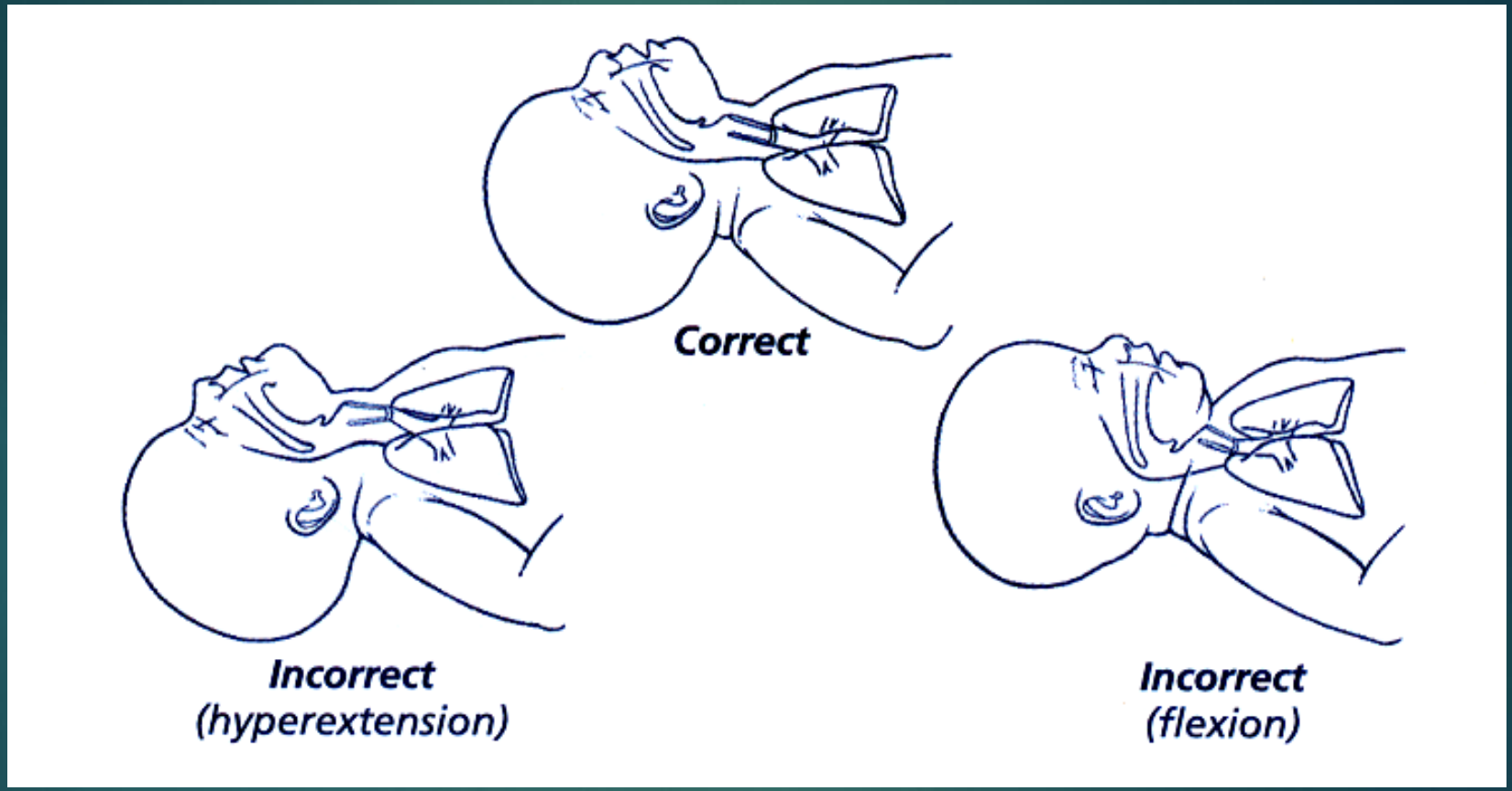
Warm and maintain normal temperature, position airway, clear secretions if needed, dry, stimulate
Apnea or gasping?
HR below 100/min?
No
Labored breathing or persistent cyanosis?



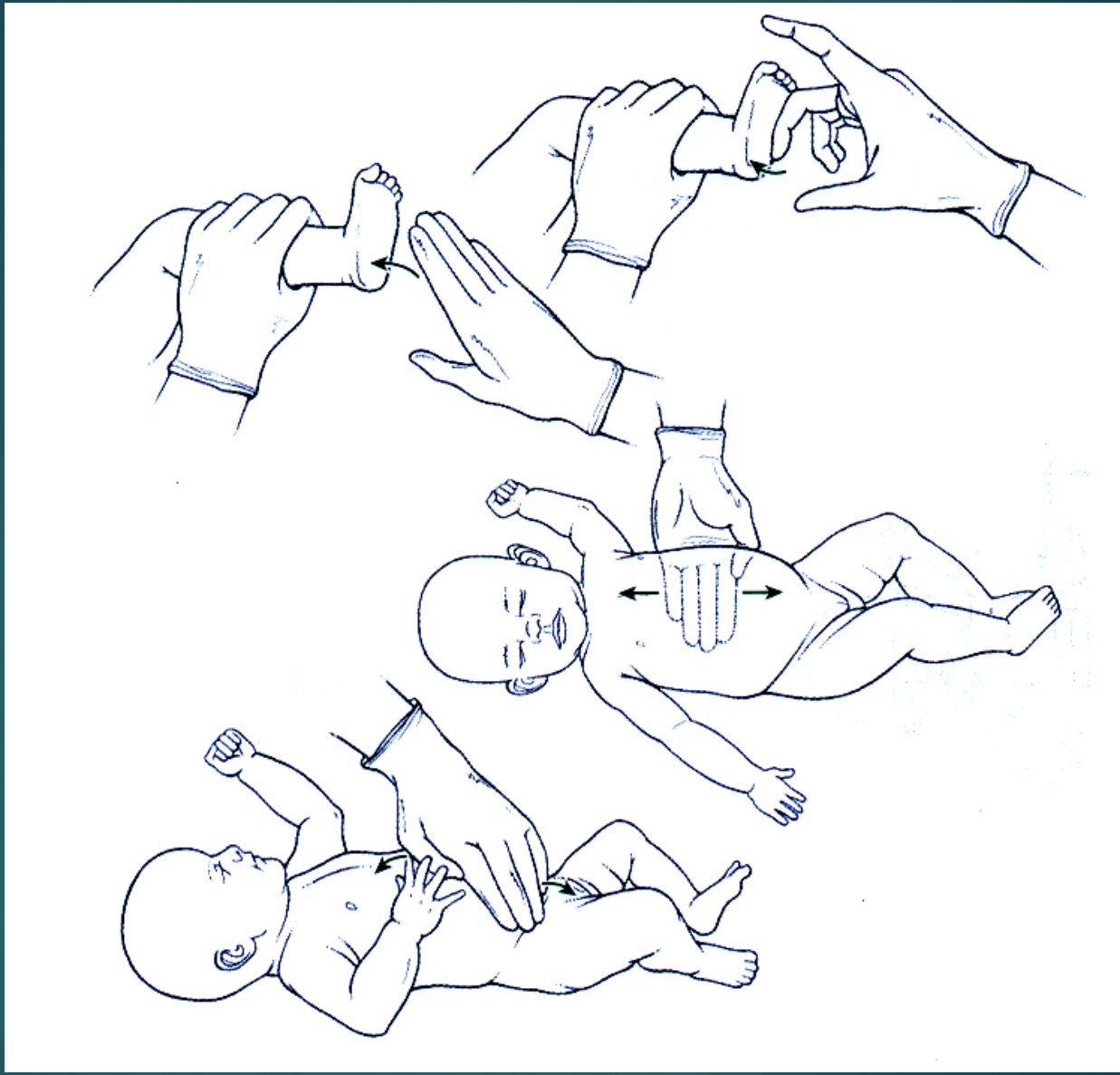

Correct
Incorrect
(hyperextension)
Incorrect
(flexion)

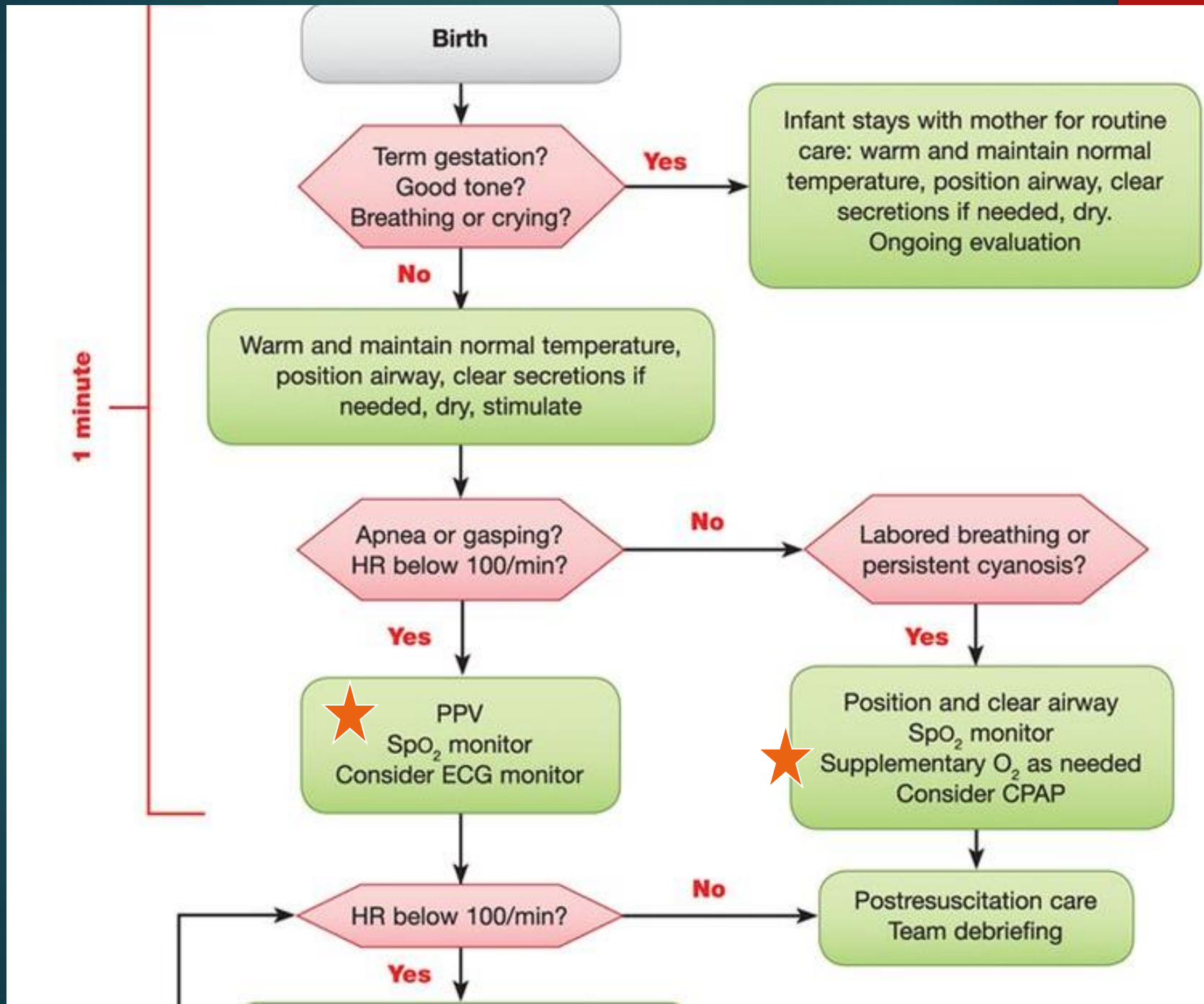

Mouth first...
then nose

Dry thoroughly

Remove wet linen

Reposition the head

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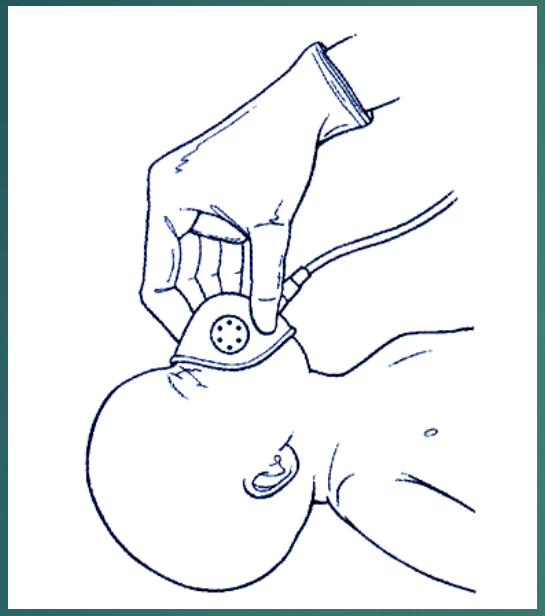
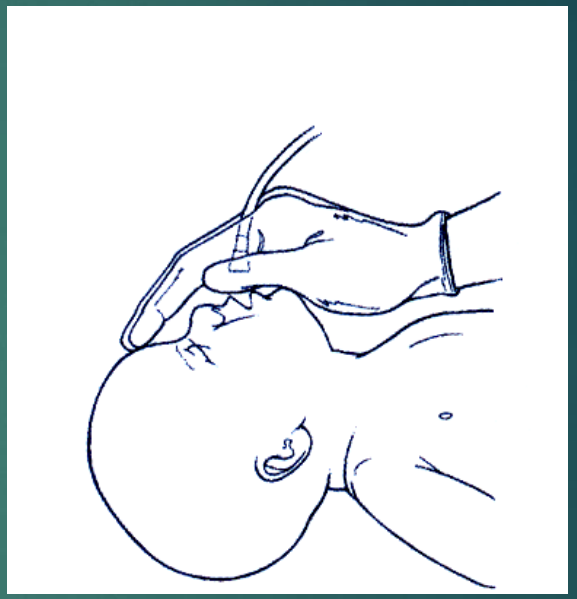
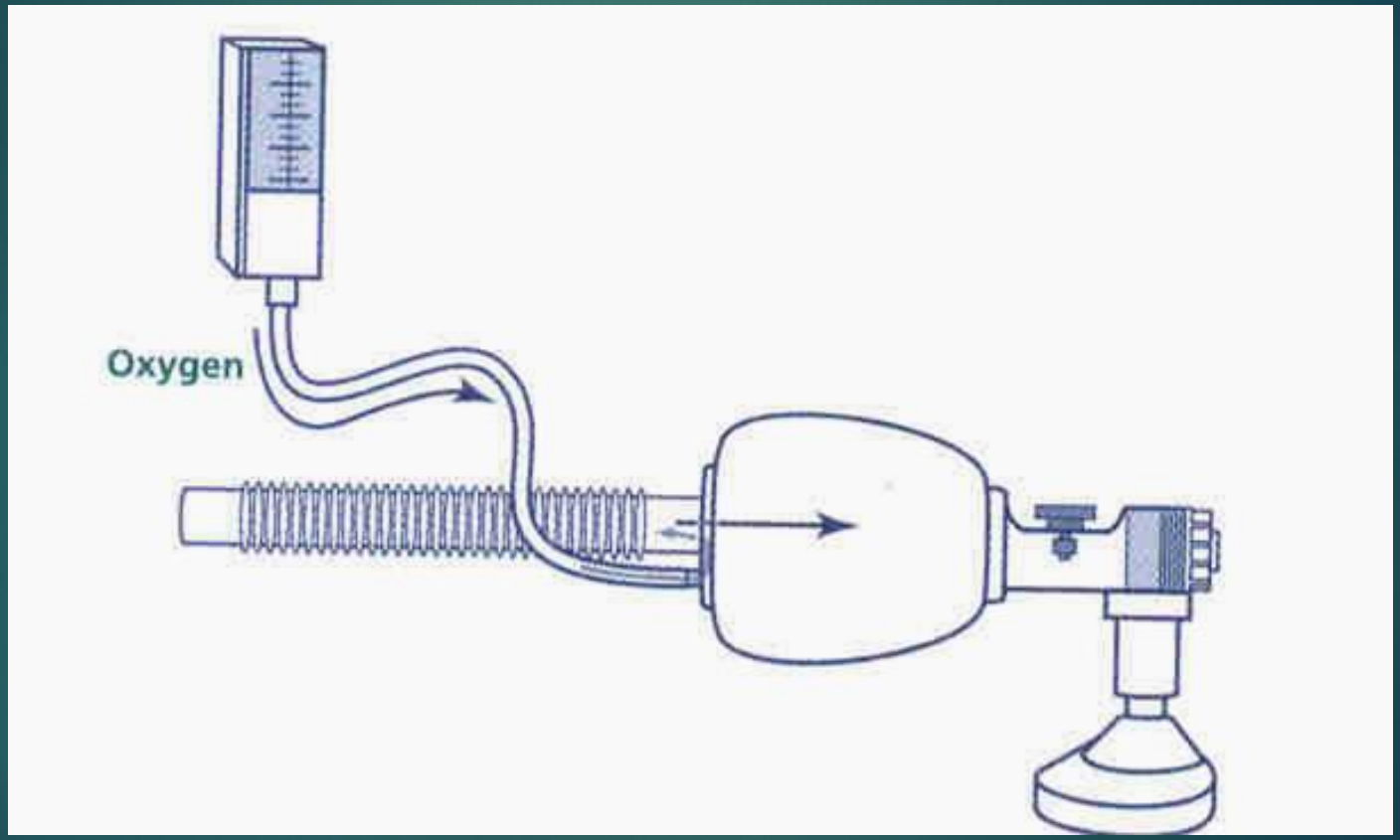
HR below 100/min?
No
Labored breathing or persistent cyanosis?
Yes
Yes
PPV
SpO2 monitor
Consider ECG monitor
Position and clear airway
SpO2 monitor
Supplementary O2 as needed
Consider CPAP
HR below 100/min?
No
Postresuscitation care
Team debriefing
Yes

Free Flow Oxygen

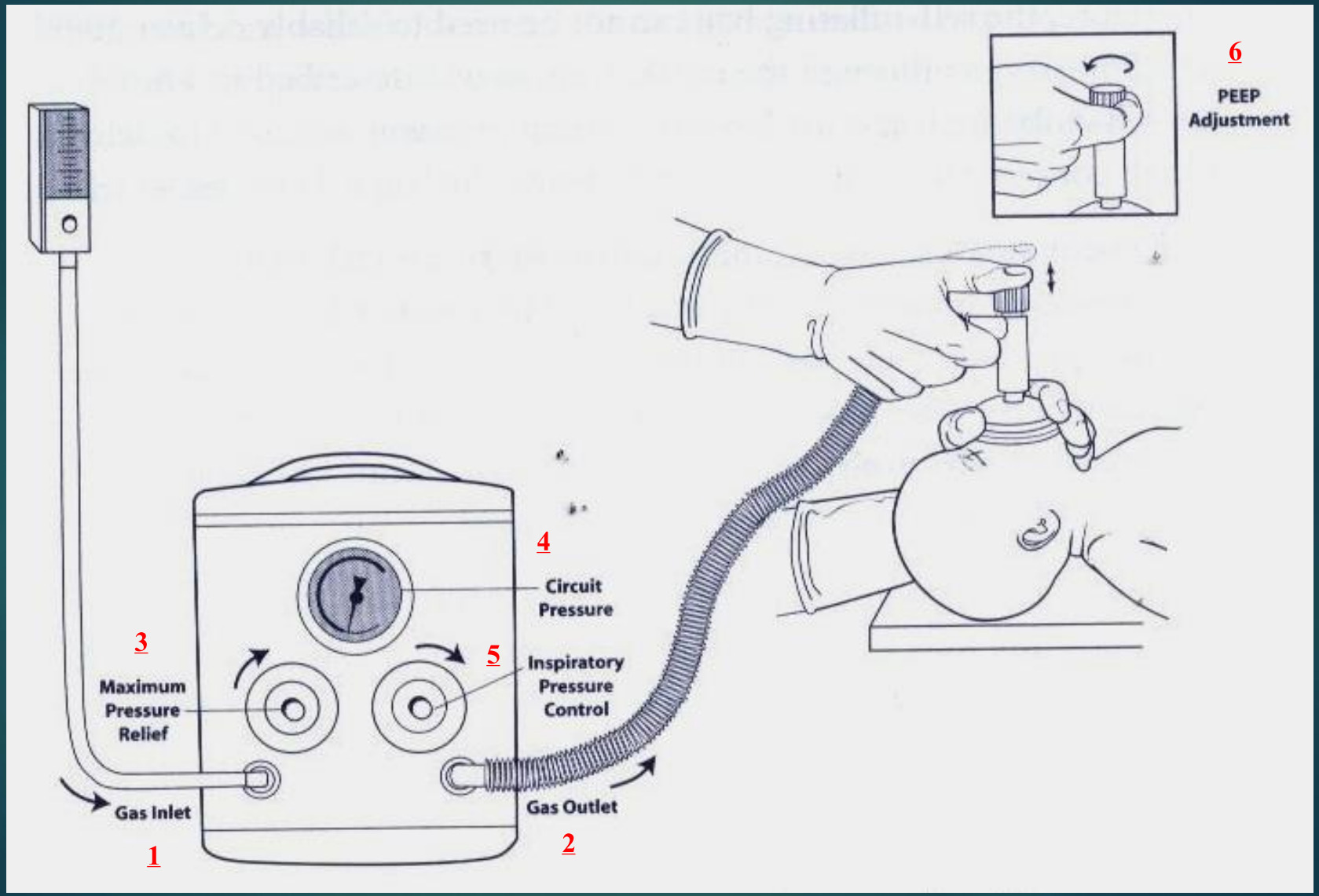


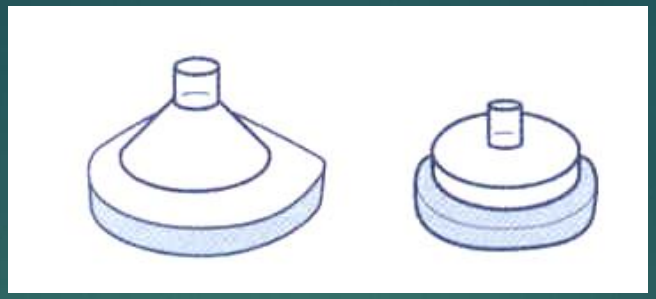


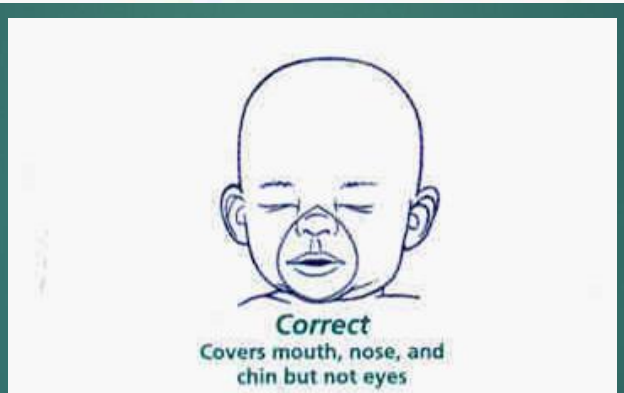
Positive Pressure Ventilation : Self-inflating Bag



T-piece Resuscitator



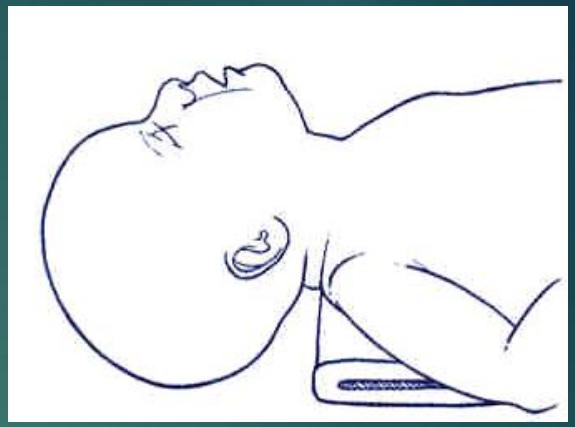


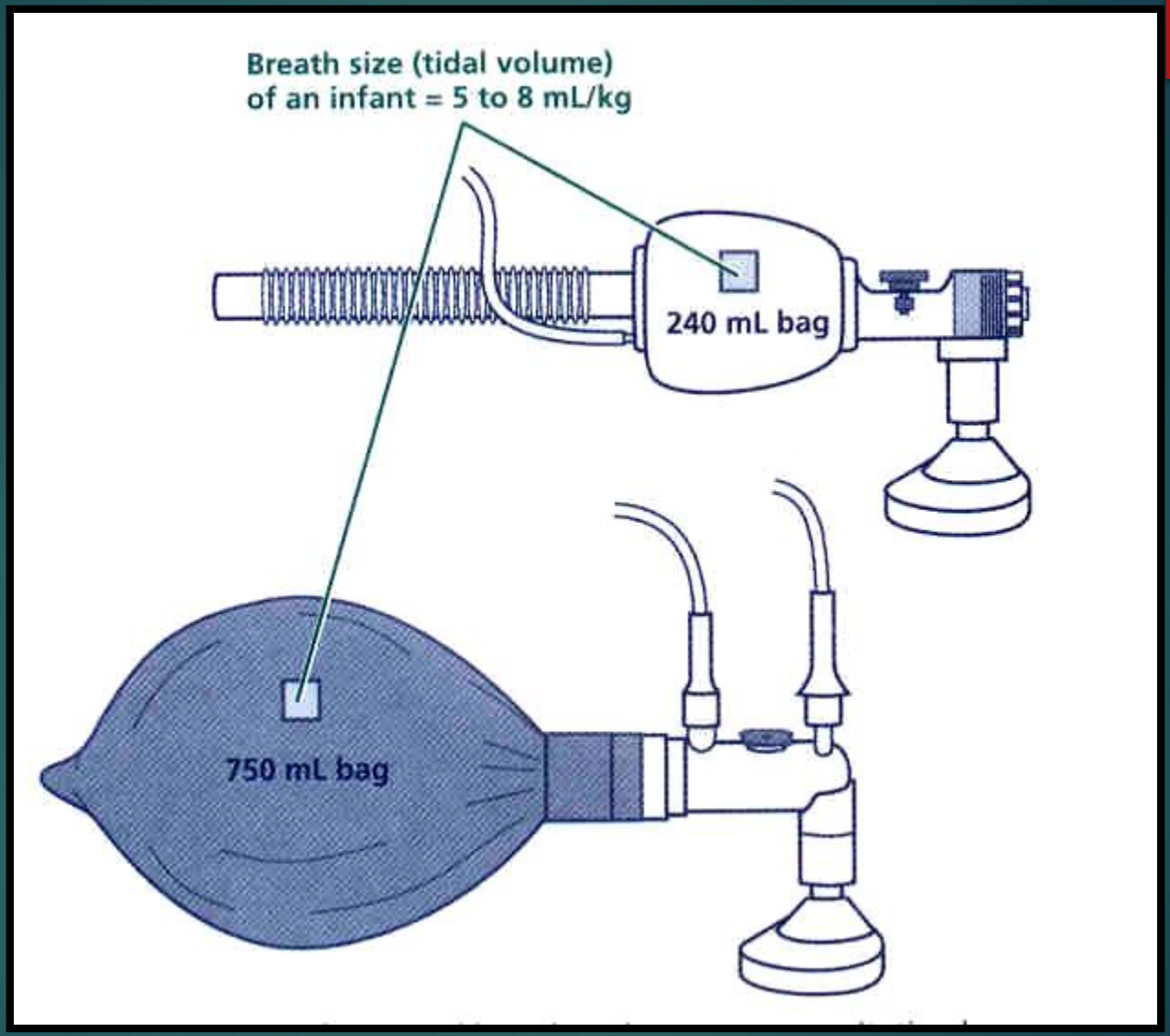


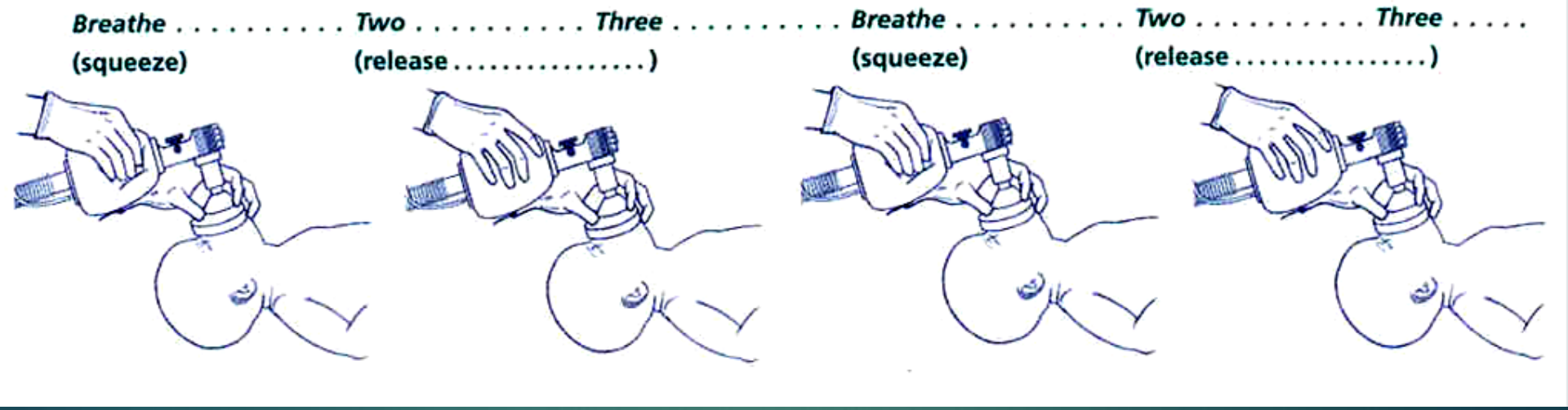
Correct
Covers mouth, nose, and chin but not eyes

Incorrect
Too large: covers eyes and extends over chin

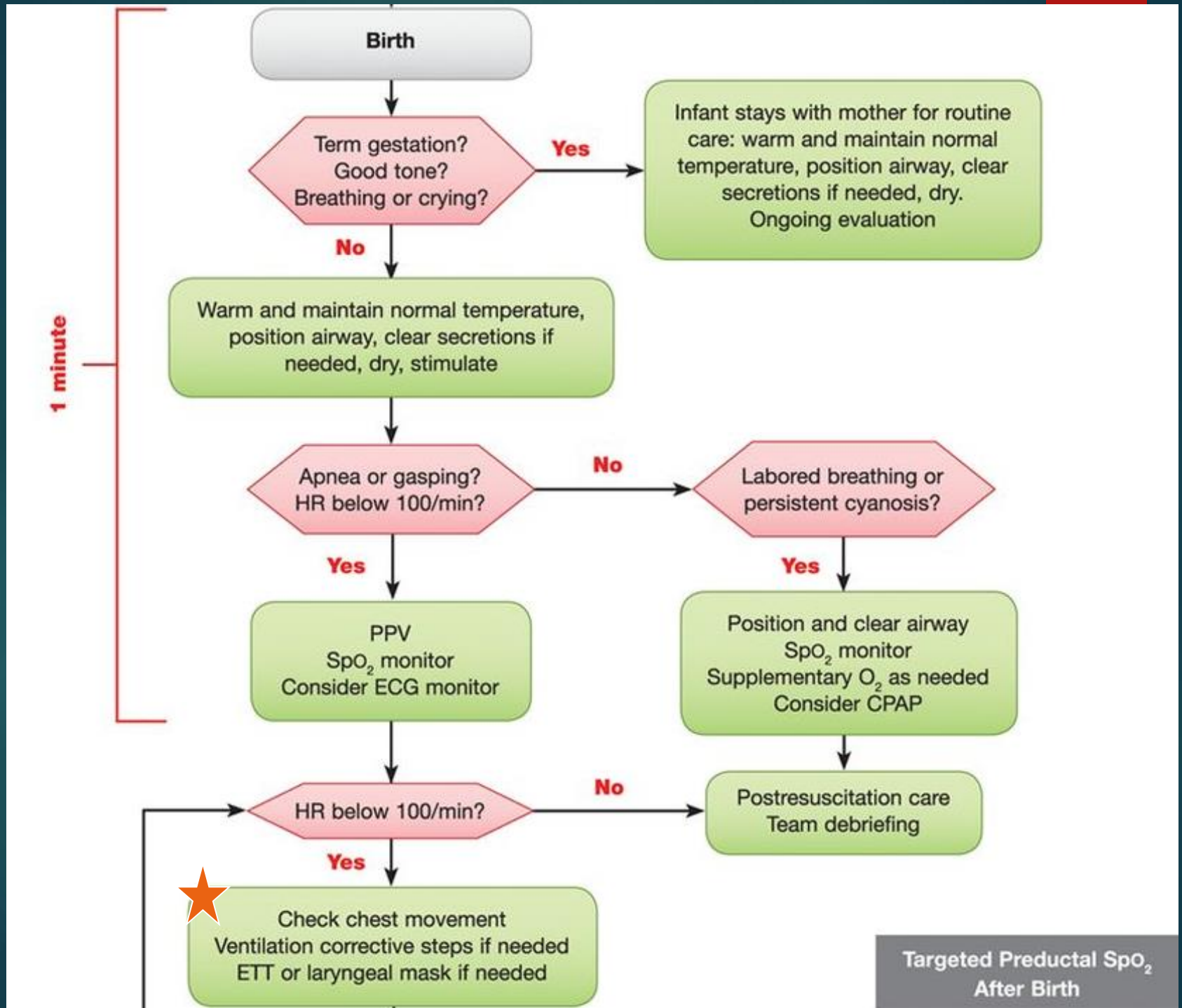
Incorrect
Too small: does not cover nose and mouth well




Breath size (tidal volume)
of an infant = 5 to 8 mL/kg
240 mL bag
750 mL bag

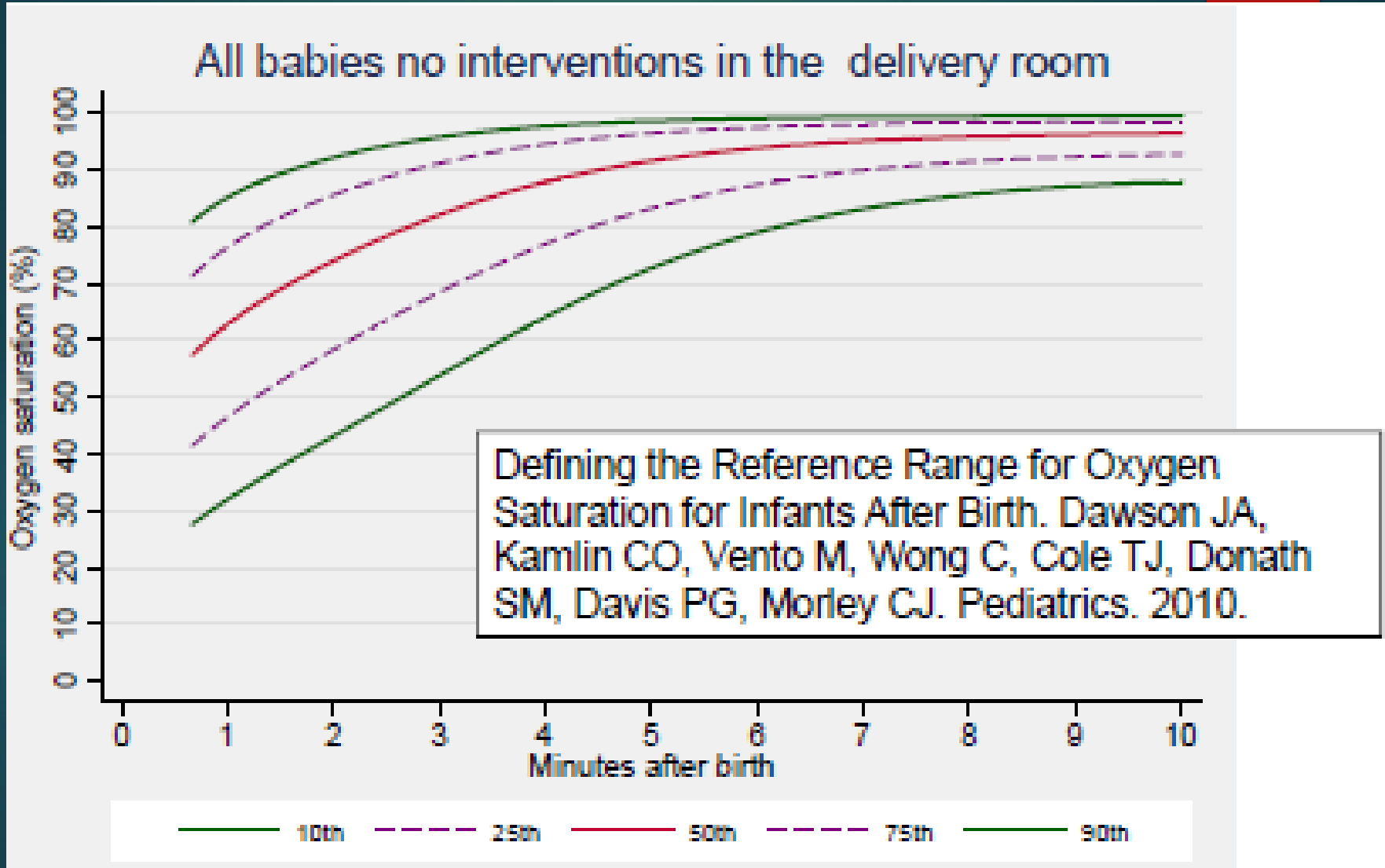


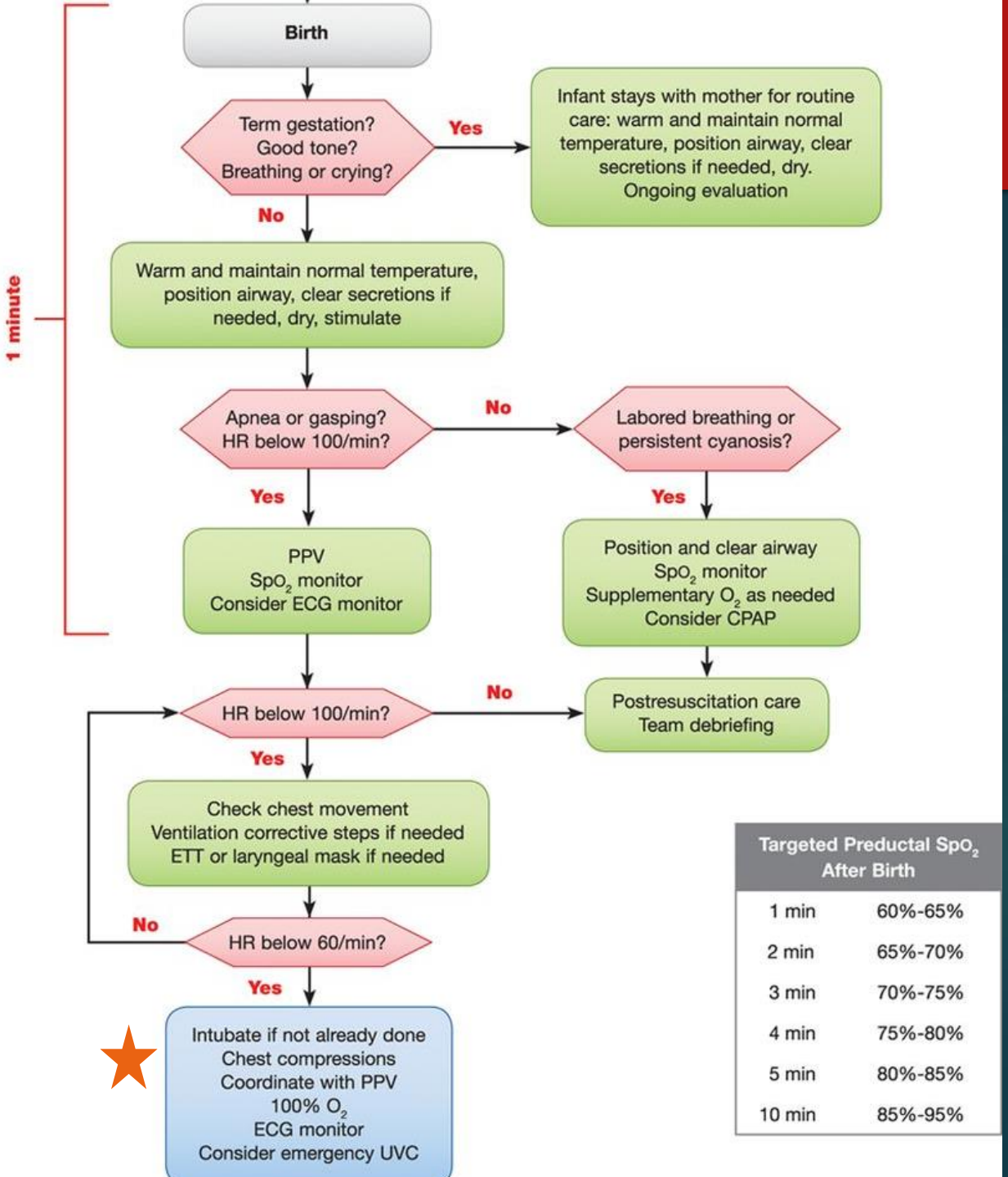
Counting out loud to maintain a rate of 40-60/min


Birth
Term gestation?
Good tone?
Breathing or crying?
Yes
Infant stays with mother for routine care: warm and maintain normal temperature, position airway, clear secretions if needed, dry.
Ongoing evaluation
No
1 minute
Warm and maintain normal temperature, position airway, clear secretions if needed, dry, stimulate
Apnea or gasping?
HR below 100/min?
No
Labored breathing or persistent cyanosis?
Yes
Yes
PPV
SpO2 monitor
Consider ECG monitor
Position and clear airway
SpO2 monitor
Supplementary O2 as needed
Consider CPAP
HR below 100/min?
No
Postresuscitation care
Team debriefing
Yes
Check chest movement
Ventilation corrective steps if needed
ETT or laryngeal mask if needed
Targeted Preductal SpO2 After Birth

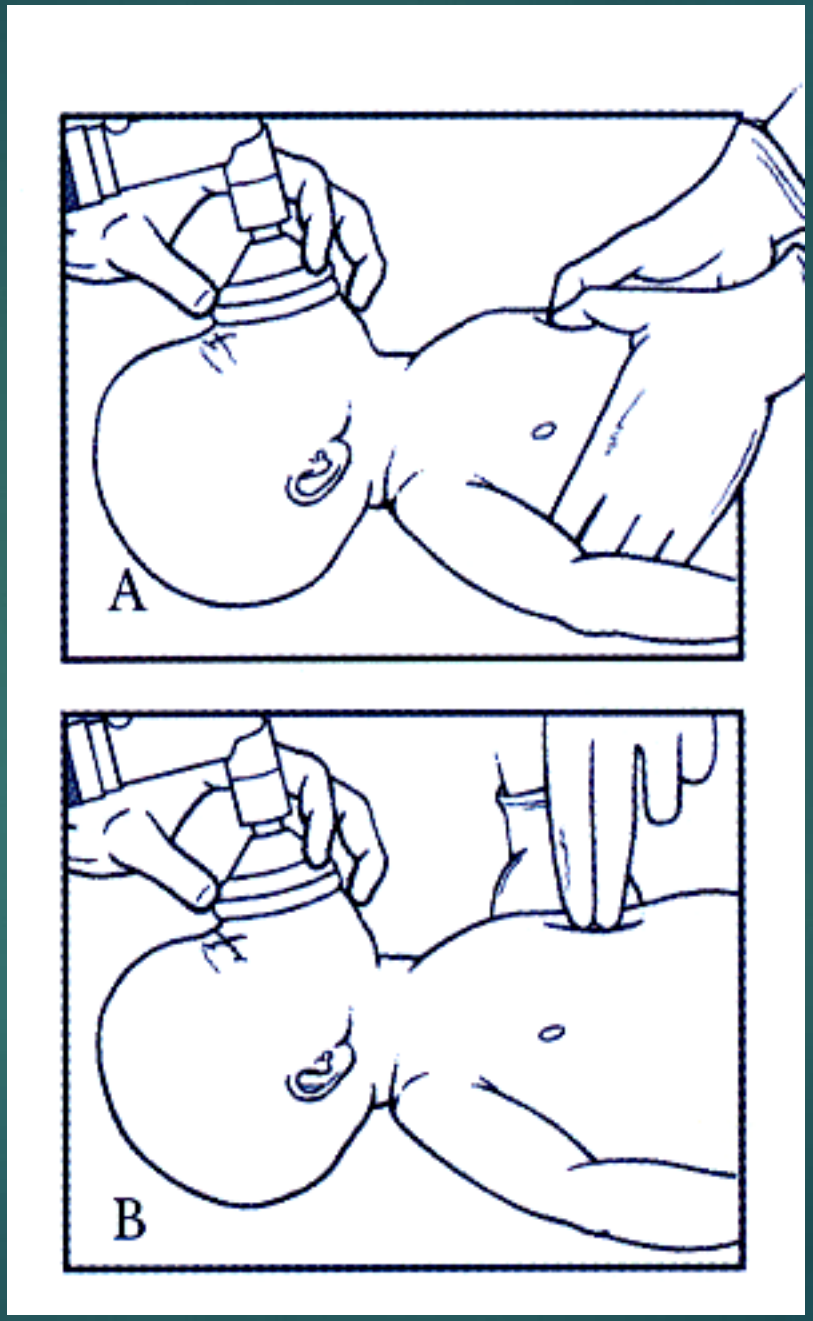
6 ขั้นตอนตรวจสอบความถูกต้องของการช่วยหายใจ MR.SOPA

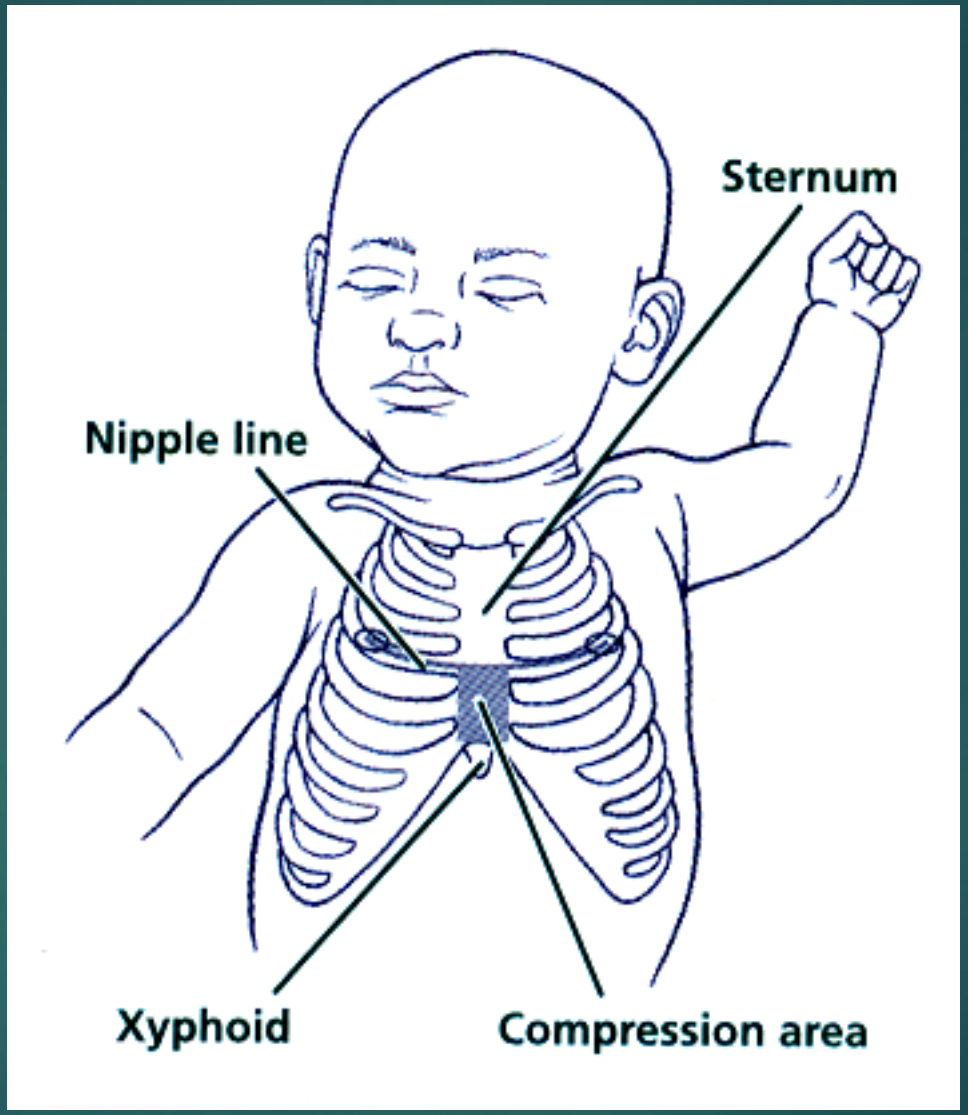
Corrective Steps	Actions
M Mask adjustment	-Reapply mask ,consider 2 hands
R Reposition airway	-Head neutral, slightly extend
S Suction mouth & nose	-Check for secretion
O Open mouth	-Open mouth, lift jaw forward
P Pressure increase	- Increase pressure 5-10 cmH_2O max 40 cmH_2O
A Alternative airway	-Place ETT or laryngeal mask

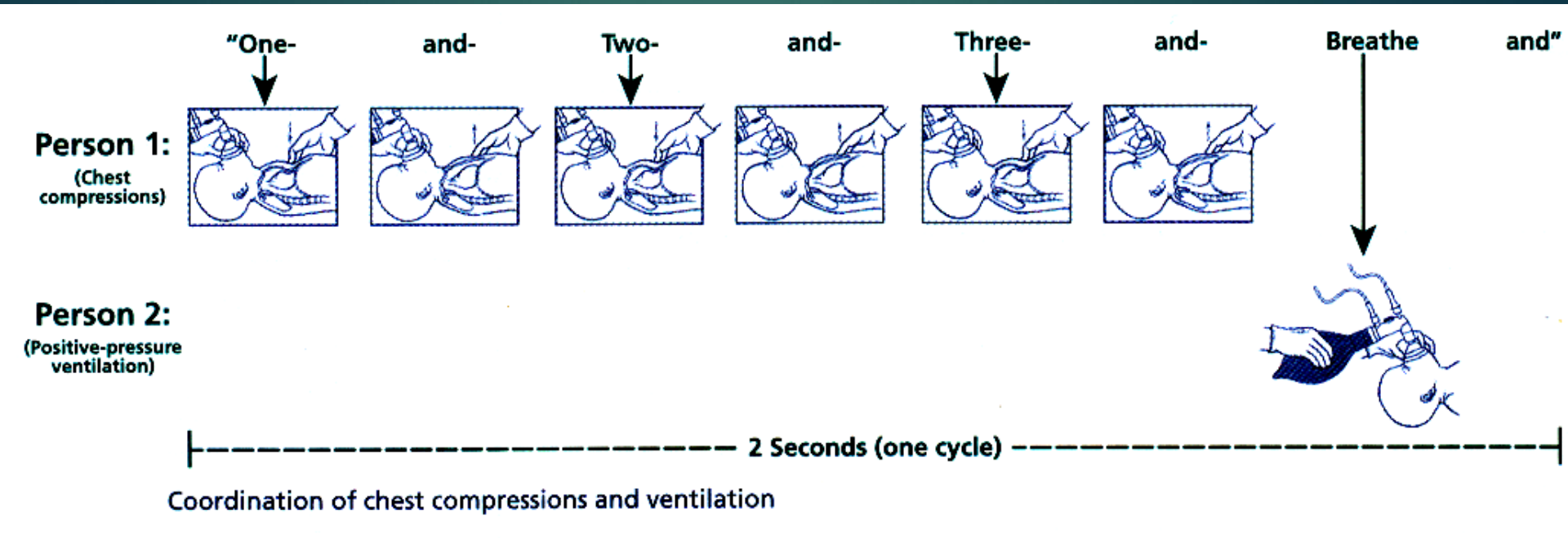

All babies no interventions in the delivery room
Oxygen saturation (%)
0
10
20
30
40
50
60
70
80
90
100
0
1
2
3
4
5
6
7
8
9
10
Minutes after birth
10th
25th
50th
75th
90th
Defining the Reference Range for Oxygen Saturation for Infants After Birth. Dawson JA, Kamlin CO, Vento M, Wong C, Cole TJ, Donath SM, Davis PG, Morley CJ. Pediatrics. 2010.



Targeted Preductal SpO_2 After Birth	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%


A
B


Sternum
Nipple line
Xyphoid
Compression area

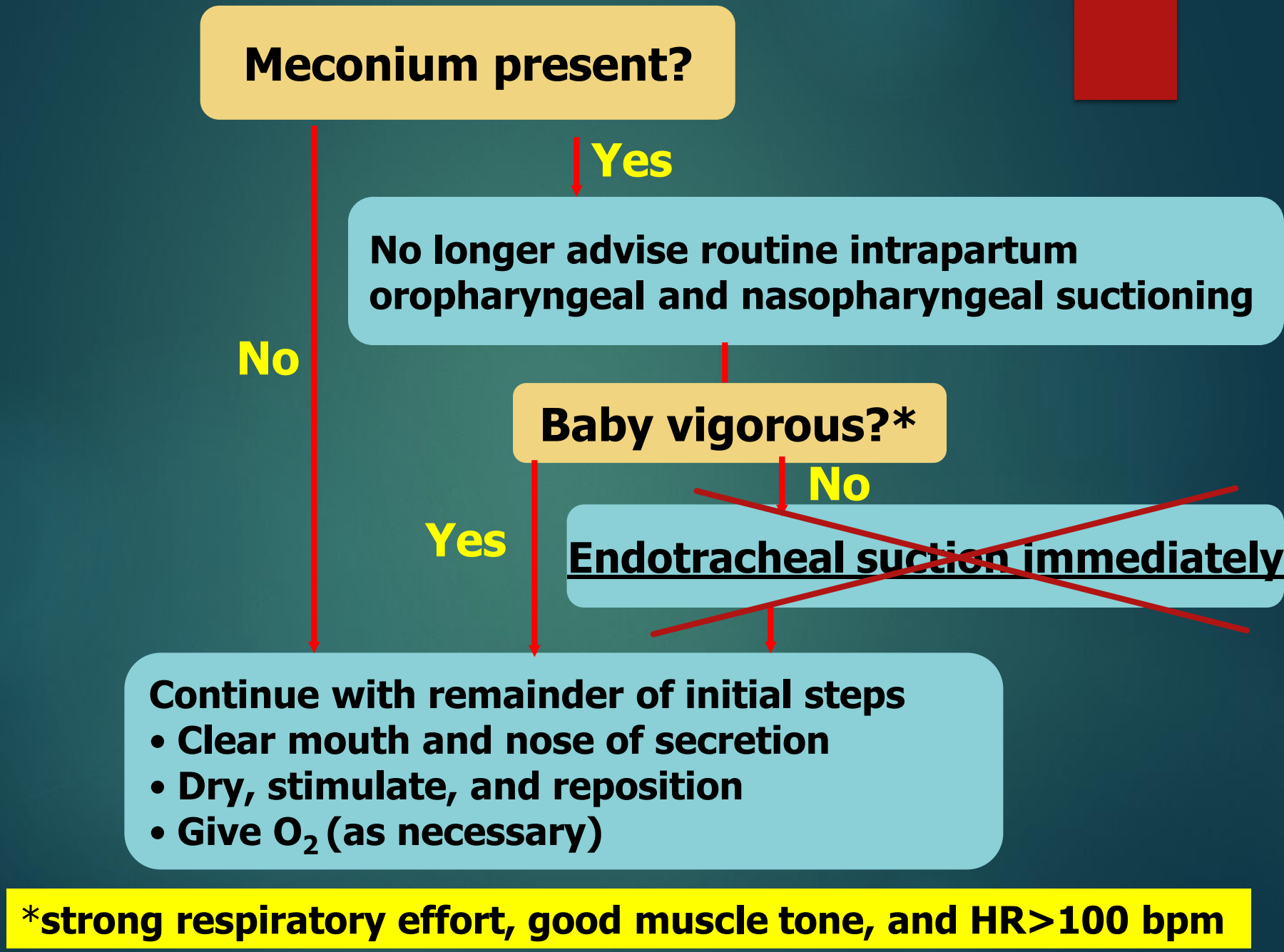


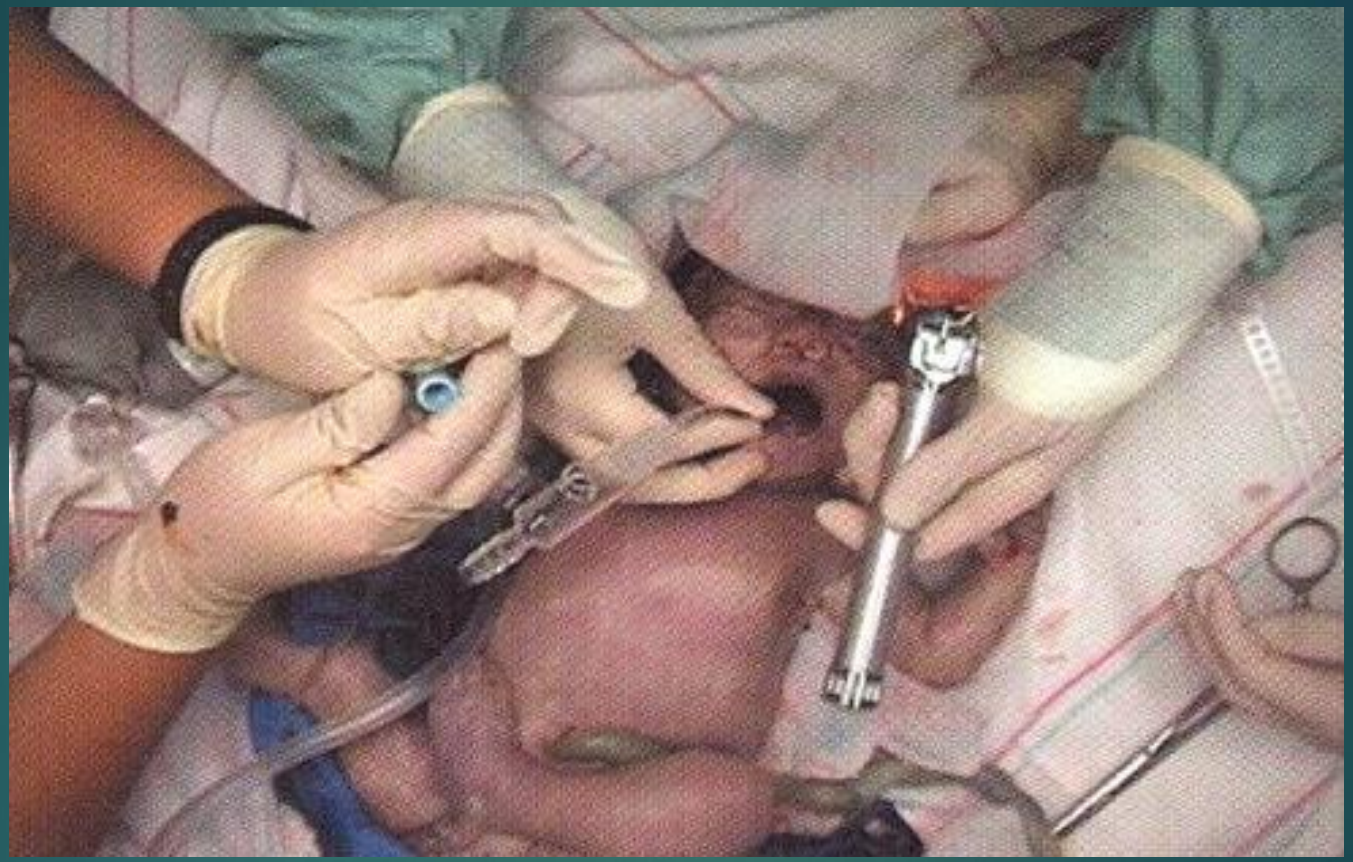
Coordination of chest compressions and ventilation

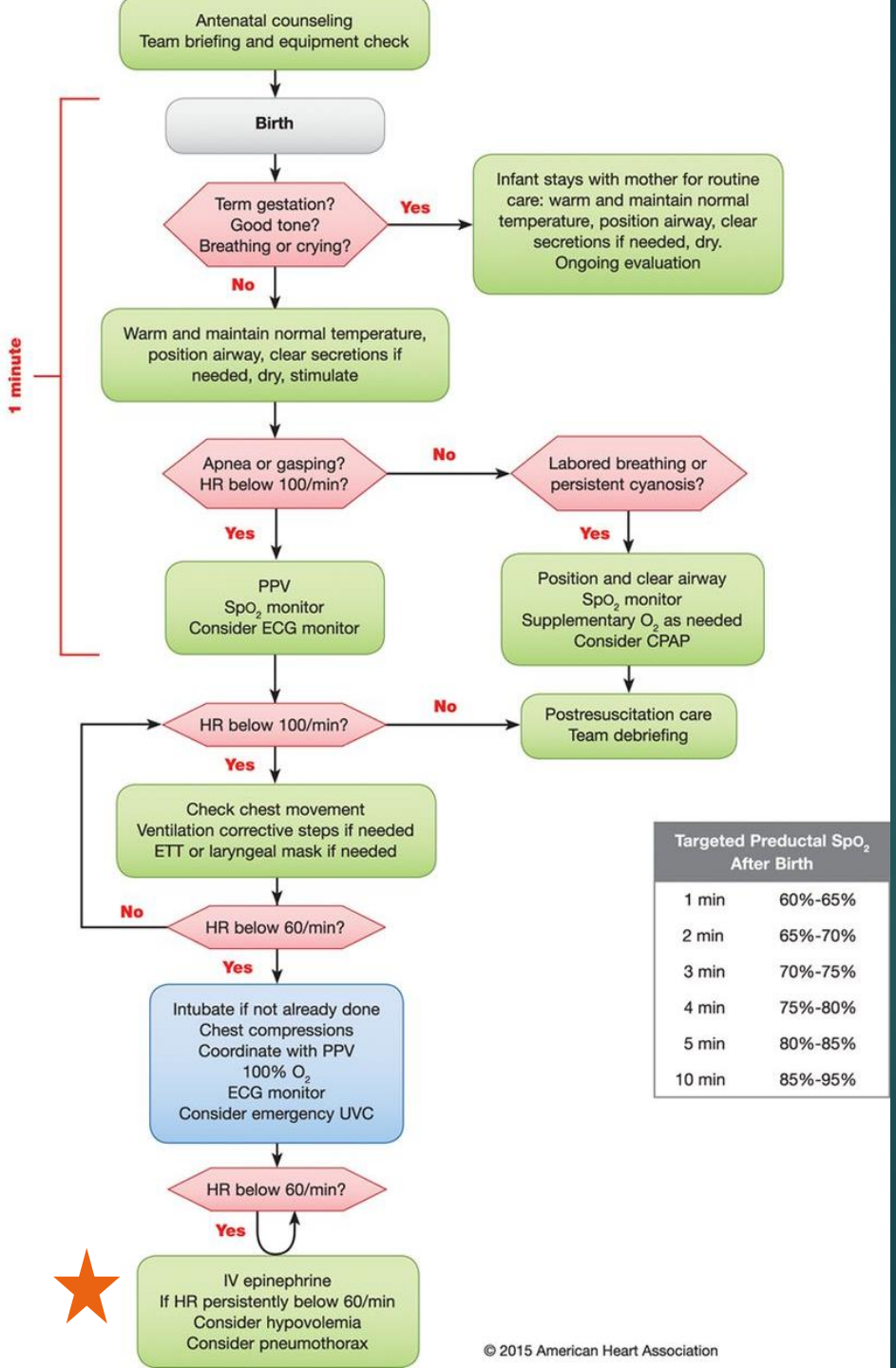
chest compression: ventilation = 3:1

Indications for Endotracheal Intubation

- Tracheal suctioning for meconium is required
- Bag -mask ventilation is ineffective or prolonged
- Chest compressions are performed
- Endotracheal administration of medications
- Special resuscitation circumstances, such as congenital diaphragmatic hernia


Meconium present?
Yes
No longer advise routine intrapartum oropharyngeal and nasopharyngeal suctioning
No
Baby vigorous?*
No
Yes
Endotracheal suction immediately
Continue with remainder of initial steps
• Clear mouth and nose of secretion
• Dry, stimulate, and reposition
• Give O_2 (as necessary)
*strong respiratory effort, good muscle tone, and HR>100 bpm

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HR below 60/min?
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Intubate if not already done
Chest compressions
Coordinate with PPV
100% O2
ECG monitor
Consider emergency UVC
HR below 60/min?
Yes
IV epinephrine
If HR persistently below 60/min
Consider hypovolemia
Consider pneumothorax
Targeted Preductal SpO2 After Birth
1 min 60%-65%
2 min 65%-70%
3 min 70%-75%
4 min 75%-80%
5 min 80%-85%
10 min 85%-95%
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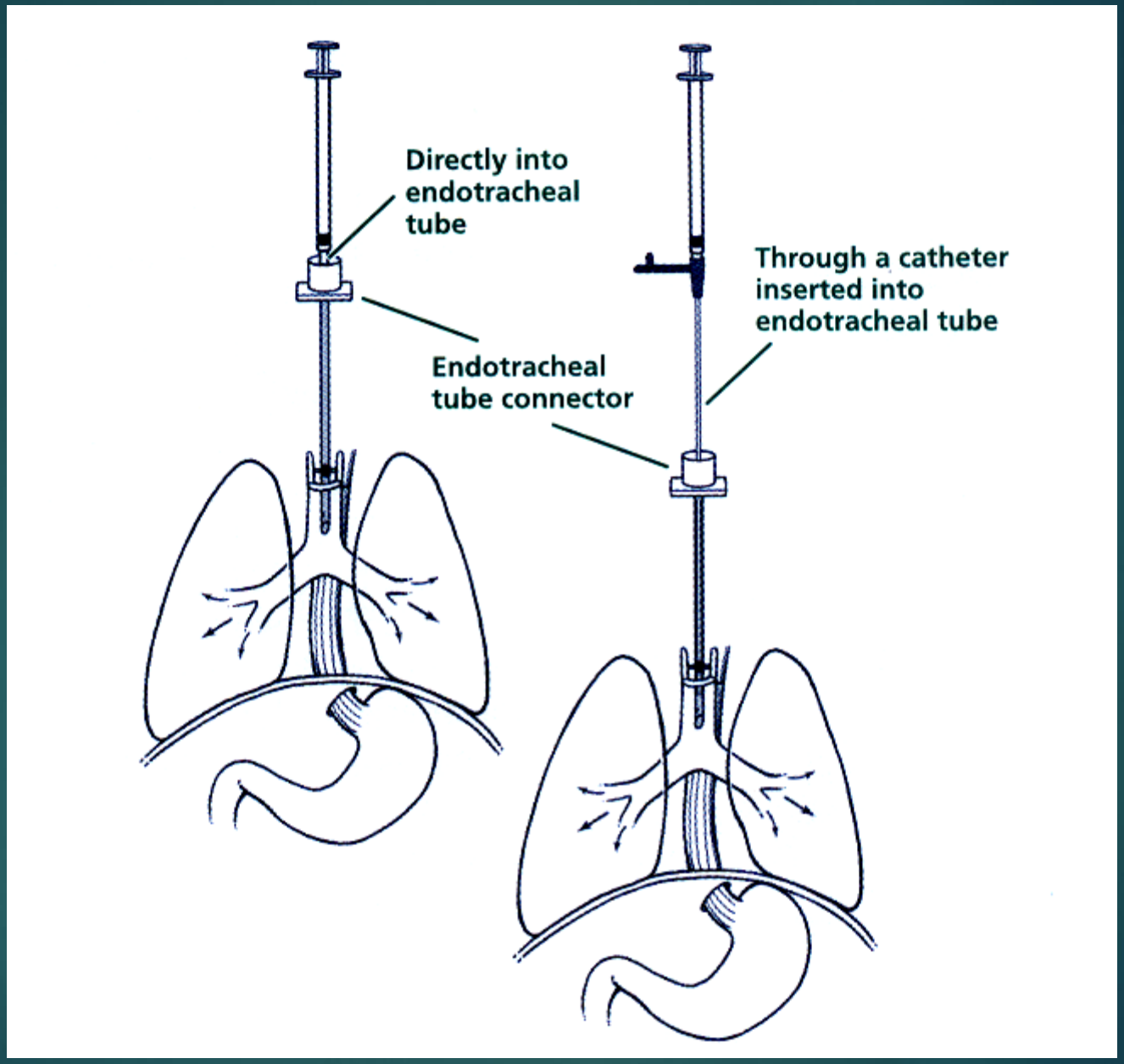
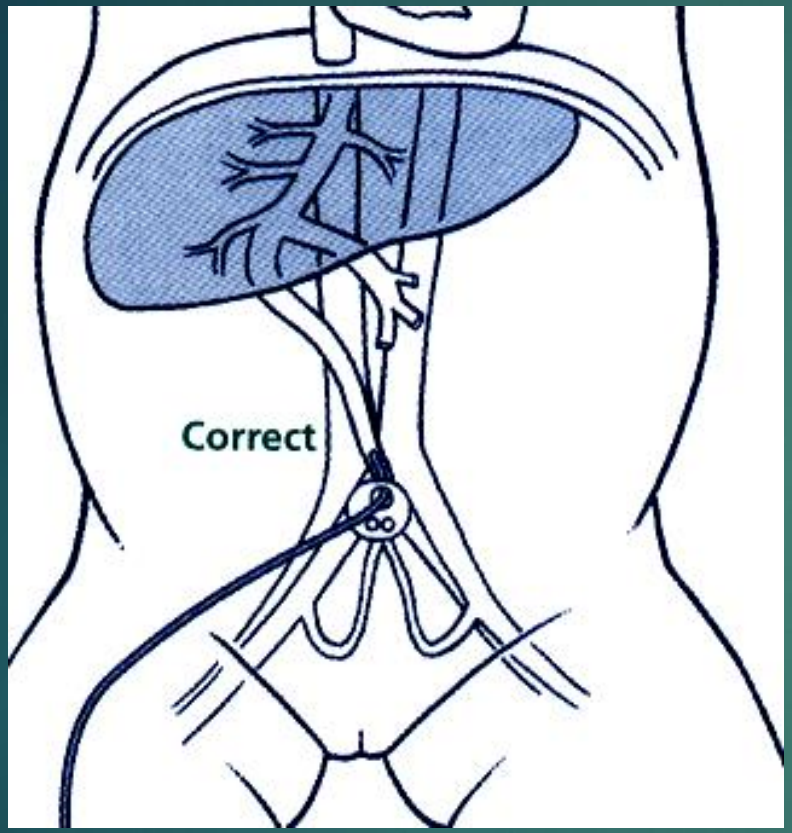
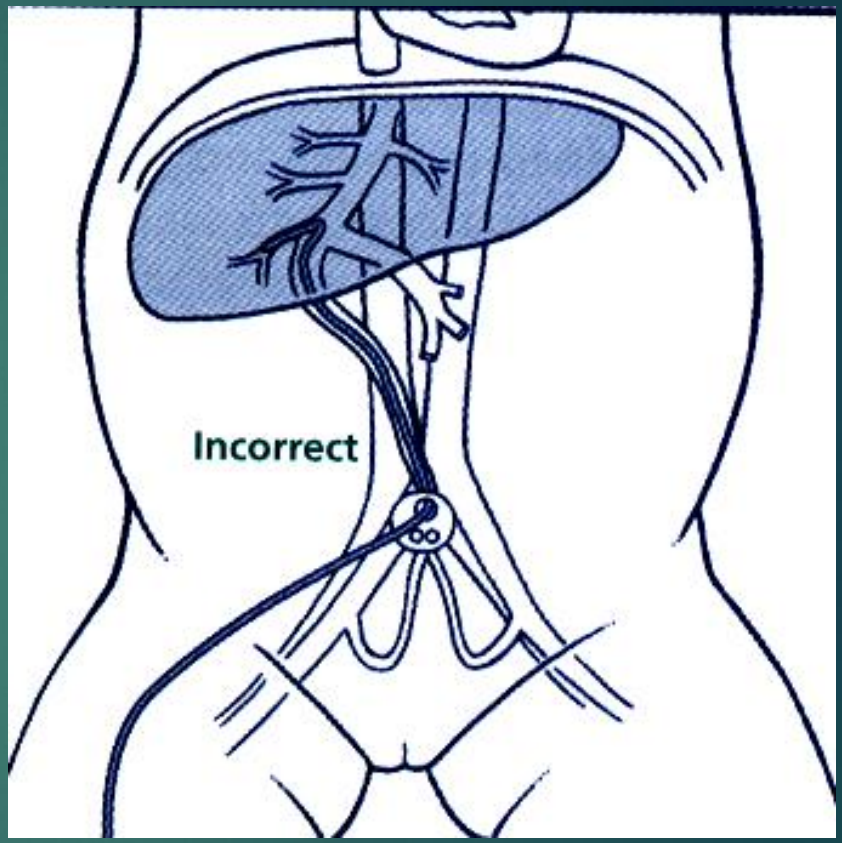
Epinephrine

- Route = IV should be used ASAP, ETT
- IV dose = 0.01-0.03 mg/kg

  0.1-0.3 mL/kg of 1:10,000 solution
- Higher dose up to 0.1 mg/kg through ETT may be considered
- Concentration = 1:10,000 for either route
- Preparation = in 1 mL syringe
- Rate = rapidly


Directly into endotracheal tube
Endotracheal tube connector
Through a catheter inserted into endotracheal tube


Correct


Incorrect

Volume Expander

- When blood loss is suspected or shock
- Recommended solution = isotonic crystalloid
- Dose = 10 mL/kg
- Route = umbilical vein
- Preparation = estimated volume in large syringe
- Rate = over 5-10 min
- Be careful in premature infants

Post-resuscitation Care

Organ	Potential complication	Post-resuscitation action
Brain	Apnea	Monitor for apnea
	Seizure	Support ventilation
		Monitor BS, electrolyte
		Avoid hyperthermia
		Consider anticonvulsant

Post-resuscitation Care

Organ	Potential complication	Post-resuscitation action
Lungs	Pulmonary hypertension	Maintain adequate oxygenation and ventilation
	Pneumonia	Consider antibiotics
	Pneumothorax	CXR if distress
	Transient tachypnea	
	MAS	
	Surfactant deficiency	Consider surfactant Delay feeding if distress

Post-resuscitation Care

Organ	Potential complication	Post-resuscitation action
Cardiovascular	Hypotension	Monitor BP, HR Consider inotrope and/or volume
Kidney	Acute tubular necrosis	Monitor urine output Restrict fluid if oliguria & adequate volume

Post-resuscitation Care

Organ	Potential complication	Post-resuscitation action
GI	Ileus	Delay feeding
	NEC	Give IV fluids
		Consider TPN
Metabolic	Hypoglycemia	Monitor blood sugar
	Hypocalcemia	Monitor electrolytes
Hematologic	Anemia	Monitor hematocrit
	Thrombocytopenia	Monitor platelets

Management of Neonatal Hypoxic-Ischemic-Encephalopathy

- Prevention of intrauterine asphyxia
- Maintenance of adequate ventilation
- Maintenance of adequate perfusion
- Control of seizures
- Control of brain swelling
- Other treatments: **Therapeutic hypothermia**

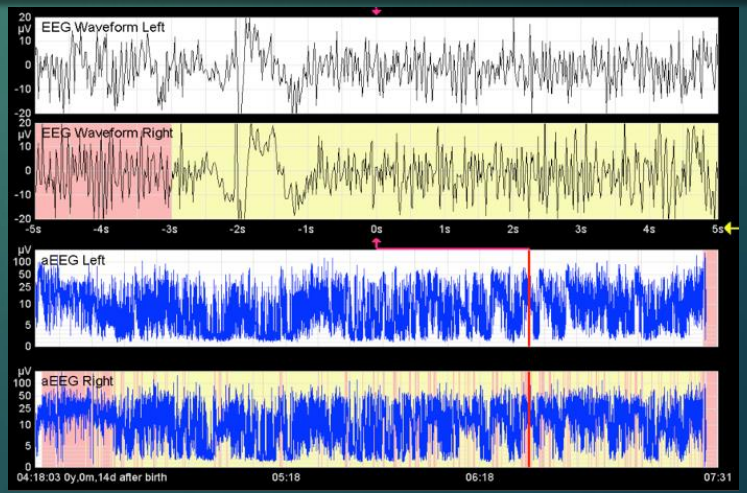
Therapeutic Hypothermia

Use mild hypothermia 33-34^{o}C

Indication: GA > 36 wk, evidence of perinatal asphyxia, moderate or severe HIE on examination

Contraindication: Age > 6 hr, BW < 2,000 g,

severe coagulopathy, severe congenital malformation or lethal chromosome abnormality



Prevention of Intrauterine Asphyxia

- Antepartum assessment and identification of high risk pregnancy
- Fetal monitoring
- Appropriate interventions : cesarean section

Predictors of mortality and neurological morbidity

- Fetal assessment : Presence of meconium
  Heart rate monitoring
  Blood acid-base analysis
- Extended Apgar score
- Onset of respiration
- Neonatal neurologic examination
- U/S, CT, MRI
- EEG

ให้ความสำคัญกับการทำงานเป็นทีม

การทำงานเป็นทีมและการสื่อสารที่ดีเป็นสิ่งสำคัญ

- Pre-resuscitation team briefing วางแผน ทบทวนสถานการณ์
  - ประเมินปัจจัยเสี่ยง
  - Team leader แบ่งหน้าที่ บทบาทที่ได้รับมอบหมาย
  - สิ่งของ อุปกรณ์ที่จำเป็นต้องใช้
  - จะขอความช่วยเหลืออย่างไร
- การสื่อสารที่มีประสิทธิภาพ
- การบันทึกที่ถูกต้อง
- Post-resuscitation team briefing เพื่อการพัฒนา

At 1 year
Normal
development