University of Nairobi

Updates on Neonatal Resuscitation

An initiative of ETAT+ Trainers in partnership with CPHD

CENTER FOR PUBLIC HEALTH & DEVELOPMENT
Saving Lives Through Innovation

saving children's lives
ETAT+
Emergency Triage Assessement and Treatment plus admission

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Outline

Prof. Grace Irimu
Facilitator

Dr. Rachael Kanguha
(Host)

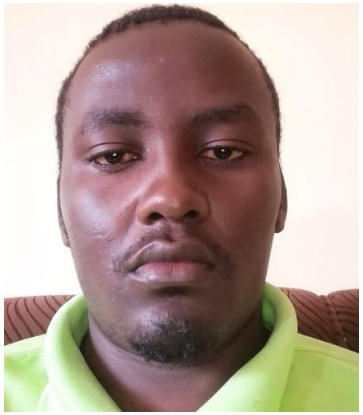
Dr. Hildy Nvonako
Transition to extrauterine life

Dr. Fareen Musa
Initial stabilization, Airway management and Circulation

Nancy Otin
Oropharyngeal suctioning & Use of plastic wraps

Dr. Roy Ndezwa
Breathing

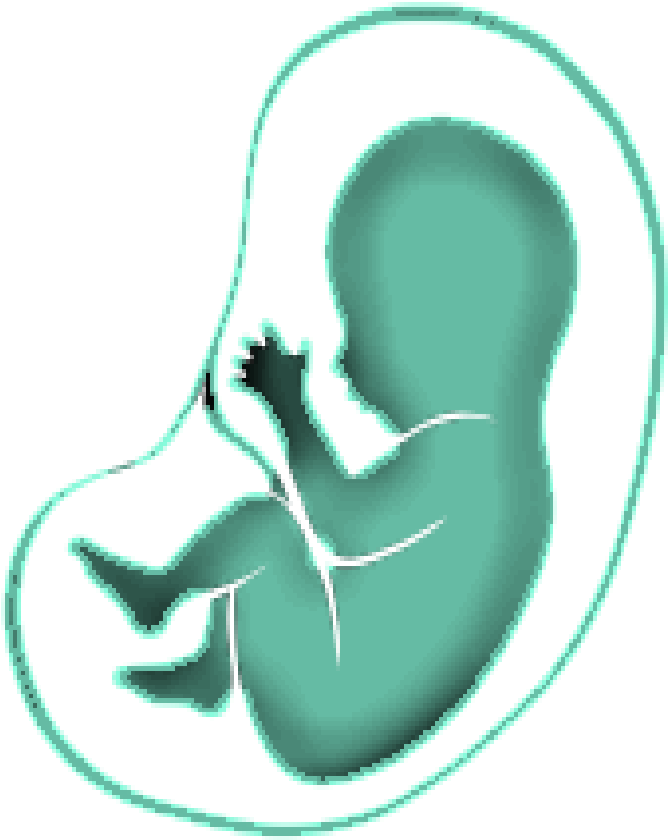
Edith Gicheha
Using the radiant warmer & IPC



Samuel Wachira
Using the radiant warmer

Fetal Transition to Extrauterine Life

Introduction



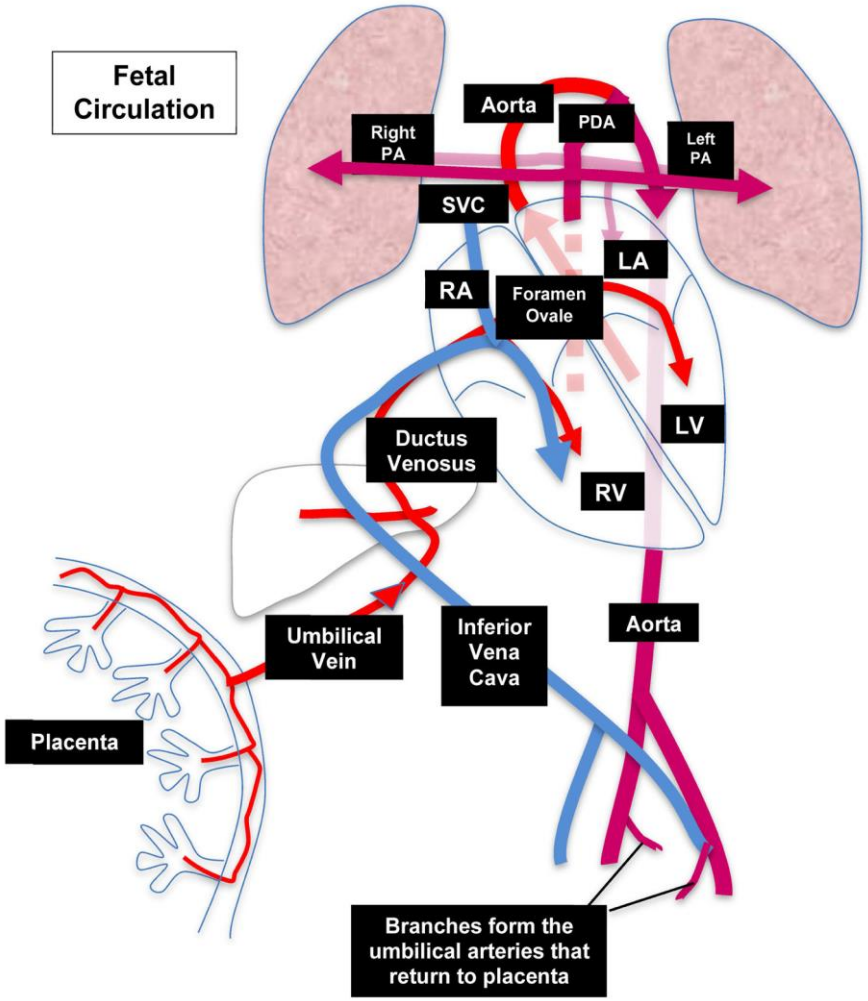
Fetal physiology is distinct from the neonate both structurally and functionally.

Transition from intra to extra-uterine life requires rapid, complex and well-orchestrated steps to ensure neonatal survival.

Understanding normal fetal transitional physiology is crucial to recognize deviations and manage timely.

Morton SU, Brodsky D. Fetal Physiology and the Transition to Extrauterine Life. Clin Perinatol. 2016;43(3):395–407

Normal Fetal Circulation



Fetal circulation begins when heart first beats at 22 days of gestation.

Initial gas exchange by yolk sac and placenta

By 10 weeks- placenta takes over.

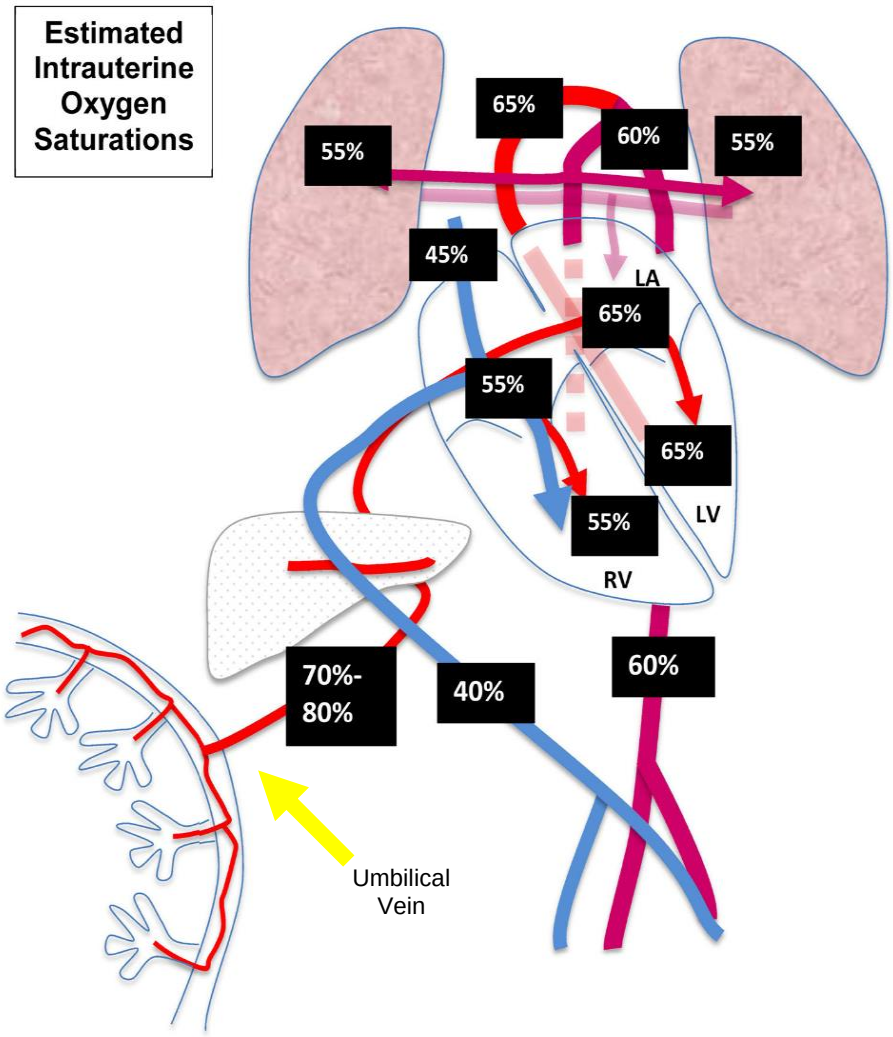
Three main shunts involved.

- Ductus venosus- **liver**
- Foramen ovale
- Ductus arteriosus

} **lungs**

Morton SU, Brodsky D. Fetal Physiology and the Transition to Extrauterine Life. Clin Perinatol. 2016;43(3):395–407.

Intrauterine Oxygen Saturations



Umbilical venous blood has $Sa0_2$ of **70% to 80%,** which is the highest $Sa0_2$ in fetal circulation.

The direction of flow of the intrauterine circulation helps to maximize 0_2 delivery to the developing brain and heart.

Morton SU, Brodsky D. Fetal Physiology and the Transition to Extrauterine Life. Clin Perinatol. 2016;43(3):395–407

Thermoregulation during transition

At birth:

Sympathetic release from stimuli[1]
- Oxygenation and Ventilation
- Cord clamping
- Cold stimulus to the skin

Thermogenesis by **brown adipose tissue** (deposited from **30 weeks – term**)

Extra-caution in keeping preterm babies warm[2] :
- Brown adipose tissue not fully developed
- Inadequate response to cold stimuli

Heat loss mechanisms at birth : Evaporation, Conduction, Convection, Radiation.

1.Hillman NH, Kallapur SG, Jobe AH. Physiology of transition from intrauterine to extrauterine life. Clin Perinatol. 2012;39(4):769–83
2.Mohamed Elshazzly; Aabha A. Anekar; Omar Caban. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan.

Cardiopulmonary Changes during transition

At birth

Baby breathes,
Umbilical cord is clamped, separating the placenta from the baby

In-utero fetal lungs are filled with Fluid, in the alveoli is absorbed after birth

Air in the alveoli causes pulmonary blood vessels to dilate

After birth

The newborn uses the lungs instead of the placenta for gas exchange

Air replaces fluid in alveoli, 0_2 is exchanged for $C0_2$

Pulmonary blood flow increases and ductus arteriosus gradually shrinks

Newborn Resuscitation: The Science of NRP 7 th Edition [Internet]. [cited 2019 May 28].

Immediate Effect of Hypoxia at Birth

Failure to take first breath

No oxygenation therefore high pulmonary vascular resistance is maintained

Inadequate blood flow to the pulmonary circulation

Hypoxaemia

Hillman NH, Kallapur SG, Jobe AH. Physiology of transition from intrauterine to extrauterine life. Clin Perinatol. 2012;39(4):769–83.

Sequelae of Hypoxia on the Newborn

- Hypoxic- ischemic brain injury
- Myocardial Ischemia
- Persistent pulmonary hypertension of the newborn
- Necrotizing enterocolitis
- Acute tubular necrosis
- Disseminated Intravascular Coagulation

Levene MI, deVries LS. Hypoxic-ischemic encephalopathy. In: Fanaroff & Martin's Neonatal-Perinatal Medicine: Diseases of the Fetus and Infant, 9th ed, Martin RJ, Fanaroff AA, Walsh MC (Eds), Elsevier, St.Louis 2011. p.952.

The Golden minute

What is the golden minute concept?

The Golden Minute refers to the first 60 seconds allocated to start initial stabilization and begin ventilation if required

Within one minute of birth, a baby should be breathing well or should be ventilated with a bag and mask.

ILCOR: Neonatal Resuscitation- Part 11 2010 AND 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care John Kattwinkel, Co-Chair; Jeffrey M. Perlman, Co-Chair*; Khalid Aziz*

The Golden Minute

- Term gestation?
- Crying or breathing?
- Good muscle tone

The golden minute

NO to any of the following may require one or more (in order)

A. Initial steps in stabilization

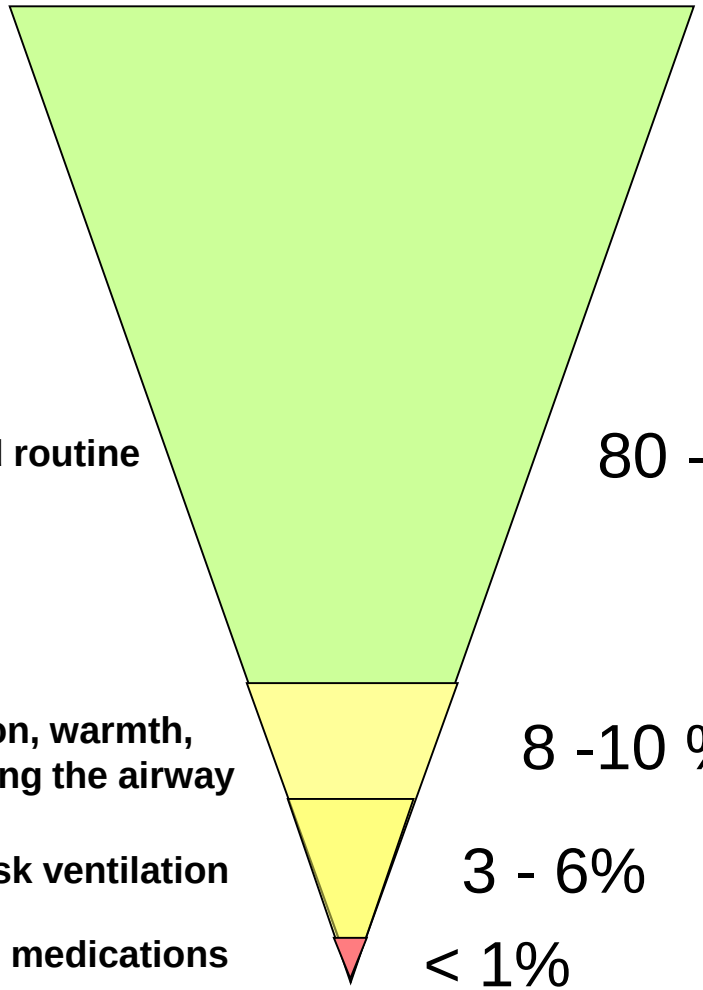
✓ Dry and stimulate,

✓ Keep warm and maintain normal temperature,

✓ Position the airway, clear secretions only if copious and/ or obstructing the airway,)

B. Ventilate and oxygenate (room air)

Interventions required by newborns at Birth



Assessment at birth and routine care — 80 - 90%

Drying, stimulation, warmth, positioning & clearing the airway — 8 -10 %

Bag and mask ventilation — 3 - 6%

Chest compressions, medications — < 1%

- Out the 1.5million babies born in Kenya annually, 10% will require more than the routine care.
- **Todays discussion focuses on the 10% (410 newborn/day)**

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Emergency Triage Assessment and Treatment plus admission

Anticipation of resuscitation

Anticipation for resuscitation

Being prepared is the first and most important step in delivering effective neonatal resuscitation.

- Assess perinatal risk factors.
- Identify a team leader and Delegate tasks.
- Supplies and equipment. **(Have a checklist)**
- Accurate evaluation of the newborn
- For high every risk delivery there should be at **least 1 person** whose primary responsibility is the **newly born**.

ILCOR newborn resuscitation guidelines 2015 part 13
Image borrowed from Weiner GM, Zaichkin J, eds. Textbook of Neonatal Resuscitation. 7th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2016:225–241

Who may need resuscitation- Anticipate and must be prepared!

At least two skilled birth attendants needed during delivery to care for both mother and child

Maternal conditions

- Maternal age (advanced or young) and Maternal DM or hypertension

Fetal conditions

- Prematurity, congenital anomalies, multiple gestations

Delivery complications

- Malpresentation, Changes in fetal HR pattern, Cesarean delivery

Antepartum complications

- Placental anomalies (eg, placenta previa or placental abruption),

Good ANC and labor management is key!!!

2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care John Kattwinkel, Co-Chair; Jeffrey M. Perlman, Co-Chair*; Khalid Aziz*

Checklist for resuscitation

Warmth

- Preheated radiant warmer
- Warm towels or blankets
- Temperature sensor and sensor cover for prolonged resuscitation
- Hat
- Plastic bag or plastic wrap (<32 weeks' gestation)
- Thermal mattress (<32 weeks' gestation)

Airway
A

- Bulb syringe
- 10F or 12F suction catheter

Breathing
B

- Bag-valve device- size 200–300 mL for neonates <5kg
- Masks: Different sizes (00, 0,1,2)
- Oxygen supply- prolonged resuscitation

Circulation
C

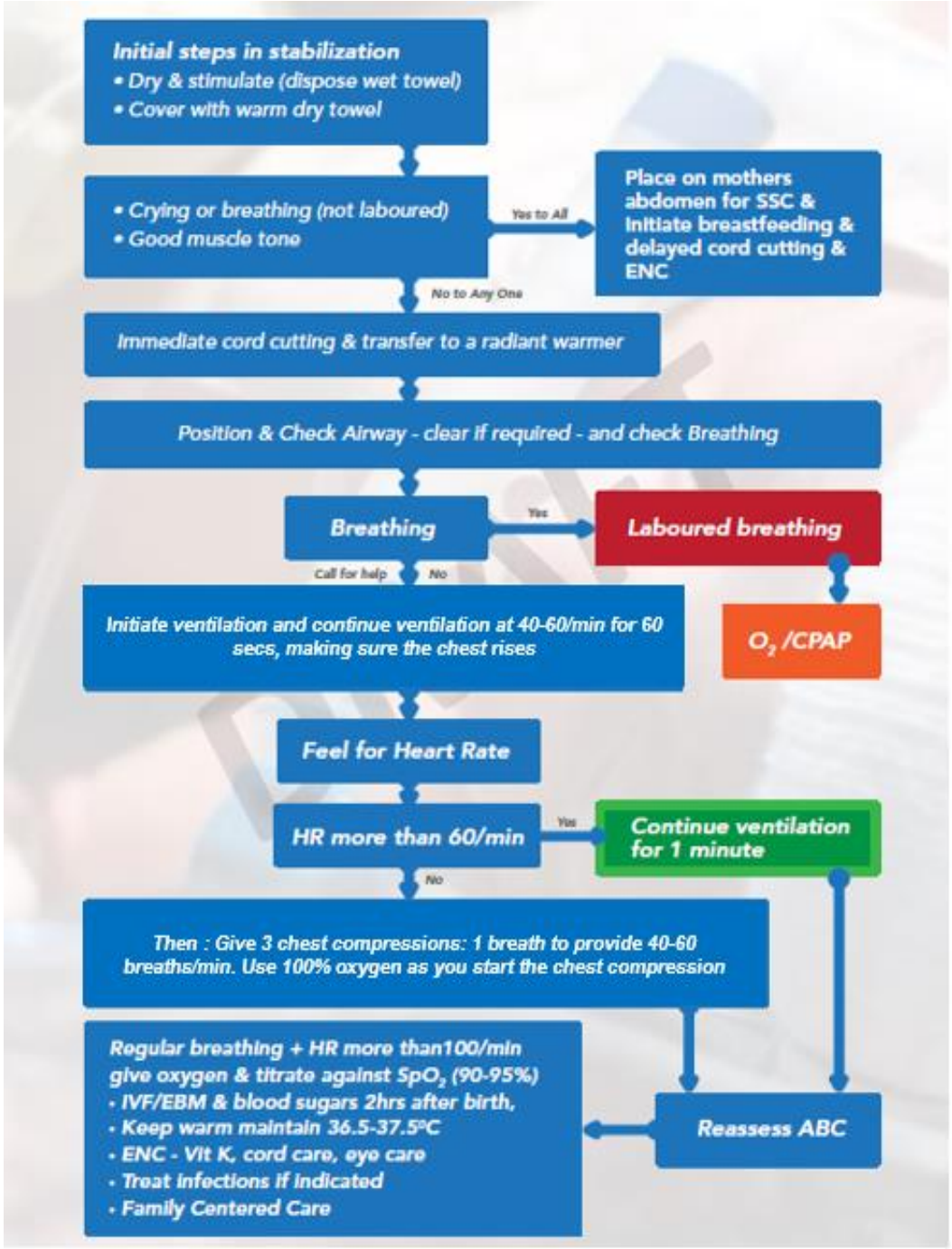
- Pulse oximeter
- Stethoscope

Drugs
D

- IV epinephrine at 0.01 to 0.03 mg/kg of 1:10 000
- Normal saline
- Blood transfusion

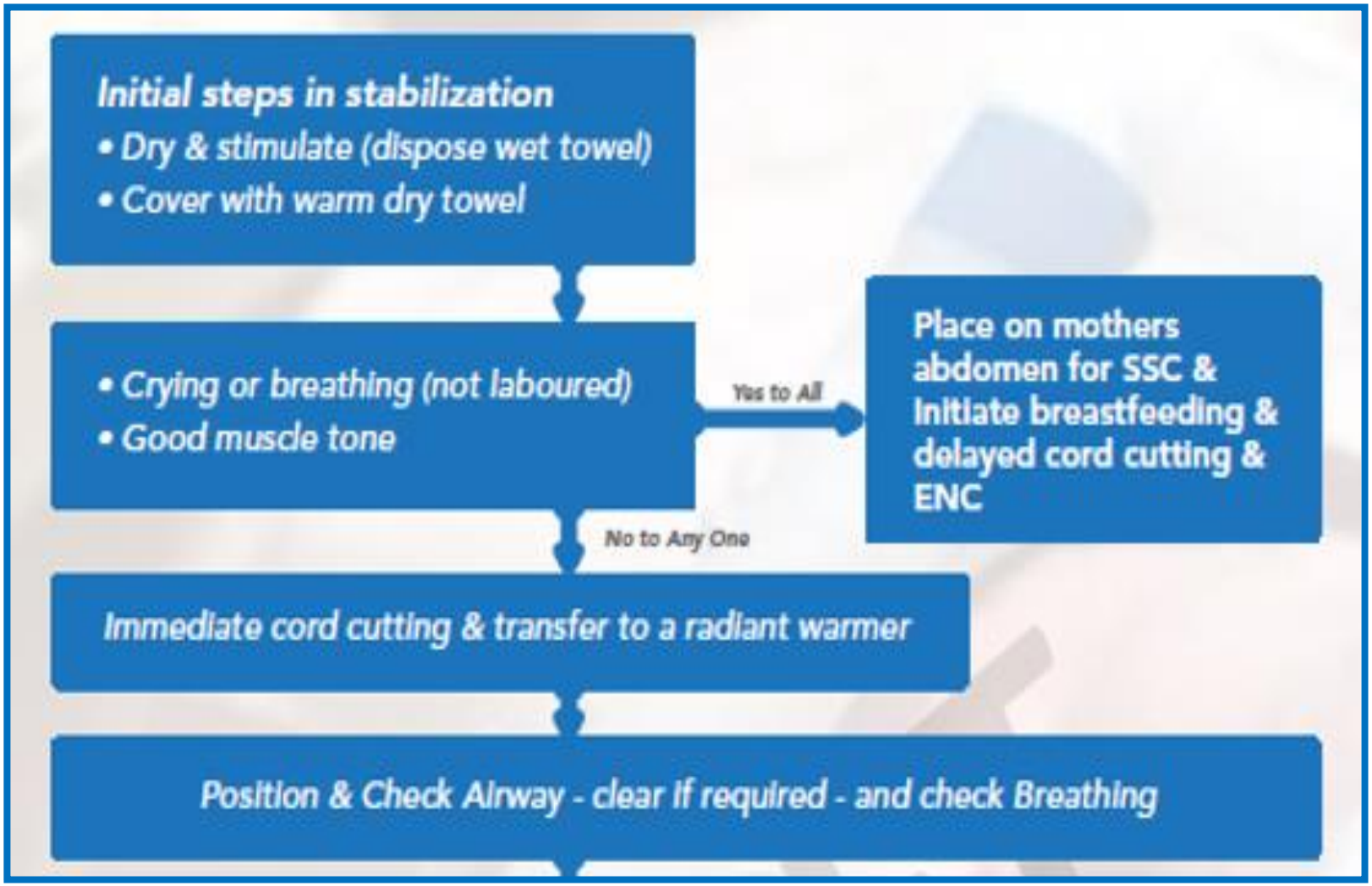
Outline


REPUBLIC OF KENYA
MINISTRY OF HEALTH
Comprehensive Newborn Care Protocols
Integrating Technologies with Clinical Care
Keprecon
KEMRI Wellcome Trust
KENYA PAEDIATRIC ASSOCIATION
CENTER FOR PUBLIC HEALTH & DEVELOPMENT
NEST360


Initial steps in stabilization
• Dry & stimulate (dispose wet towel)
• Cover with warm dry towel
• Crying or breathing (not laboured)
• Good muscle tone
Yes to All
Place on mothers abdomen for SSC & Initiate breastfeeding & delayed cord cutting & ENC
No to Any One
Immediate cord cutting & transfer to a radiant warmer
Position & Check Airway - clear if required - and check Breathing
Breathing
Yes
Laboured breathing
Call for help
No
Initiate ventilation and continue ventilation at 40-60/min for 60 secs, making sure the chest rises
O2 /CPAP
Feel for Heart Rate
HR more than 60/min
Yes
Continue ventilation for 1 minute
No
Then : Give 3 chest compressions: 1 breath to provide 40-60 breaths/min. Use 100% oxygen as you start the chest compression
Regular breathing + HR more than100/min
give oxygen & titrate against SpO2 (90-95%)
• IVF/EBM & blood sugars 2hrs after birth,
• Keep warm maintain 36.5-37.5°C
• ENC - Vit K, cord care, eye care
• Treat infections if indicated
• Family Centered Care
Reassess ABC

Initial Stabilization

Initial steps in stabilization



Neonatal Resuscitation2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care and https://moodle.digital-campus.org/mod/page/view.php?id=1229

Temperature control

- **The goal is to achieve normothermia (36.5-37.5^{o}C) and avoid iatrogenic hyperthermia.**
- Hyperthermia and hypothermia associated with worse neurological outcomes.
- Temp. monitoring is crucial

Special groups;

- Very low-birth-weight (<1500 g) babies are more likely to become hypothermic
- Asphyxiated newborns

Neonatal Resuscitation2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care and https://moodle.digital-campus.org/mod/page/view.php?id=1229

Techniques of Temperature regulation

Keeping warm

- Prewarmed delivery room to 25°C
- Prewarmed linen
- Use of a hat

For babies who don't require resuscitation

- Placing the baby skin-to-skin with the mother and covering both with a blanket

Special circumstances

- Prewarmed radiant warmer- REQUIRE RESUSCITATION.
- Less than 32 weeks- Covering the baby in plastic wrapping and Exothermic mattress

2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care John Kattwinkel; Jeffrey M. Perlman; Khalid Aziz et al 2010

Image borrowed from Weiner GM, Zaichkin J, eds. Textbook of Neonatal Resuscitation. 7th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2016:225–241

Use of Plastic Bags wrap for premature neonates

Current recommendation

- Use of plastic bags/ wraps recommended for preterm babies below 32 weeks.
- Avoids hypothermia
- No effect on mortality demonstrated

McCall EM, Alderdice F, Halliday HL, Vohra S, Johnston L. Interventions to prevent hypothermia at birth in preterm and/or low birth weight infants. Cochrane Database of Systematic Reviews 2018, Issue 2. Art. No.: CD004210. DOI: 10.1002/14651858.CD004210.pub5.
Oatley HK, Blencowe H, Lawn JE. The effect of coverings, including plastic bags and wraps, on mortality and morbidity in preterm and full-term neonates. J Perinatol. 2016;36 Suppl 1(Suppl 1):S83-S89. doi:10.1038/jp.2016.35
Image borrowed from https://au.news.yahoo.com/premature-baby-kept-alive-in-sandwich-bag-after-mothers-silent-labour-30917148.html

Umbilical cord management

Current recommendations

Delayed cord (1-3mins) clamping

For newborns with a good heart rate and spontaneous breathing

Immediate cord cutting

For newborns who require resuscitation/ below 32 weeks

Delayed umbilical cord clamping associated with:

- ✓ Improved transitional circulation,
- ✓ Better establishment of red blood cell volume,
- ✓ Decreased need for blood transfusion
- ✓ Lower incidence of necrotizing enterocolitis
- ✓ Lower incidence of intraventricular hemorrhage

Delayed Umbilical Cord Clamping After Birth- Maria A. Mascola, MD; T. Flint Porter, MD; and Tamara Tin-May Chao, MD. 2017
2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care John Kattwinkel; Jeffrey M. Perlman; Khalid Aziz et al 2010
Image borrowed from https://www.ctvnews.ca/health/researchers-develop-molecule-that-boosts-cord-blood-stem-cells-1.2013287

What about babies requiring resuscitation?

- Delayed cord cutting not appropriate

Current recommendation

Umbilical cord milking is NOT recommended- has been associated with intraventricular hemorrhage amongst preterms

Katheria A, Reister F, Essers J, et al. Association of Umbilical Cord Milking vs Delayed Umbilical Cord Clamping With Death or Severe Intraventricular Hemorrhage Among Preterm Infants. JAMA. 2019;322(19):1877–1886. doi:10.1001/jama.2019.16004

Airway

Airway positioning

Figure 3.5. CORRECT: "sniffing" position

Sniffing position- Positioned on the back (supine), with the head and neck slightly extended

Current Recommendation

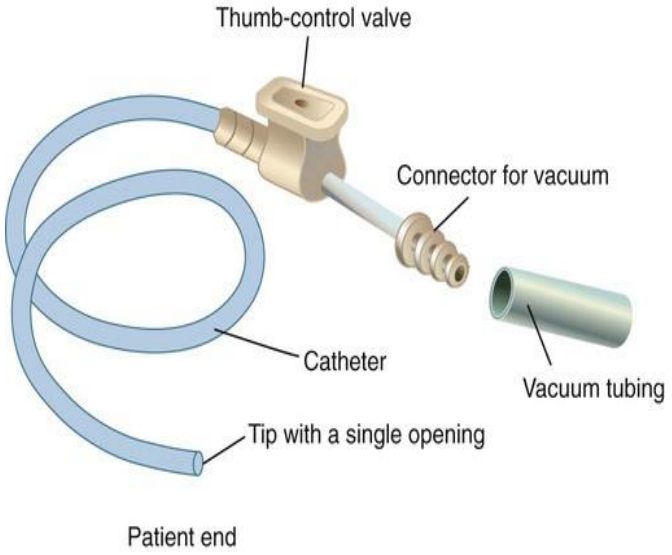
- Neonates should be placed in the 'sniffing position' to maintain airway patency.
- May need to be supported with a towel at the shoulders to maintain airway patency
- Studies showed that airway obstruction persisted with neutral position
- Sniffing position shown to be better at maintaining airway patency

Neonatal Resuscitation2015 American Heart Association Guidelines Update forCardiopulmonary Resuscitation and EmergencyCardiovascular Care and https://moodle.digital-campus.org/mod/page/view.php?id=In
Images borrowed from Weiner GM, Zaichkin J, eds. Textbook of Neonatal Resuscitation. 7th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2016:225–241

Airway suctioning in newborns

Current Recommendation

- Routine suctioning is not recommended!!!
- Suctioning immediately following birth should be reserved for babies who have
  - **Obvious obstruction of the airway (e.g. with secretions)**
- Only done when secretions seen in the mouth or nasopharynx and only suction what you see
- Nasopharyngeal suctioning can create bradycardia during resuscitation.



2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care
John Kattwinkel; Jeffrey M. Perlman; Khalid Aziz et al 2010

Oropharyngeal suctioning

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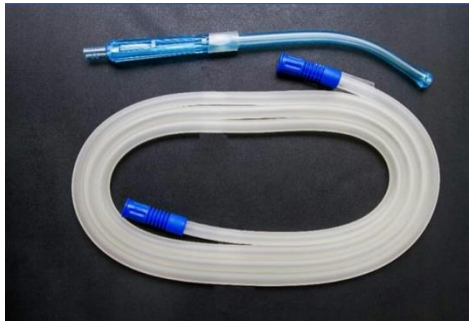
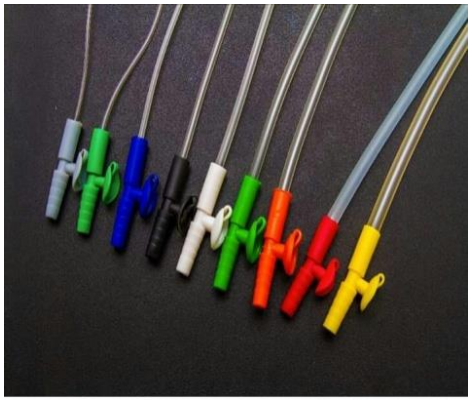
Oropharyngeal Suctioning





Manual Suction using a bulb or penguin sucker

Suction using a suction machine attached to a wide bore sucker (yankeur) or a suction catheter

Wear Appropriate PPE

Image source: NEST Clinical Modules – www.NEST360⁰.org

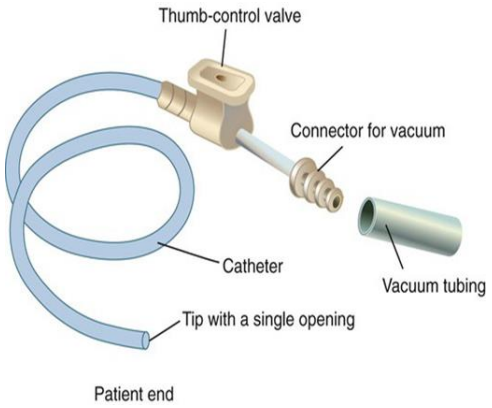
Performing Suctioning

- Talk to the mother (parents) about the procedure.
- Put the baby in a slightly extended position
- For manual suctioning using the penguin/bulb sucker;
    1. Squeeze the sucker and introduce it into the mouth
    2. Release the sucker while in the mouth to create negative pressure
    3. Suck the secretions out and pour the secretions on a gauze

Performing Suctioning using Wide Bore Sucker

- When using a suction machine with the wide bore sucker;
    1. Connect the wide bore sucker to the suction machine
    2. Set the pressures at 80 – 100mm/Hg
    3. Only suck what is visible in the mouth
    4. For very thick secretions add 2 drops of normal saline in the mouth.

Performing Suctioning using a Suction Catheter



1. Select the appropriate suction catheter to use (Fr Gauge 6 or 8) & attach catheter to the suction machine

2. Turn on machine and Set a pressure of 80 - 100mm/Hg

3. Measure the distance from the side of the nose to the lower lobe of the ear.

4. With the thumb control valve open, gently insert the catheter into the patient's mouth or nostril to the point marked by the tape/marker.

NEST Clinical Modules – www.NEST360⁰.org & Weiner GM, Zaichkin J, Kattwinkel J (eds): Textbook of Neonatal Resuscitation, ed 7. Elk Grove Village, American Academy of Pediatrics, 2016.

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Performing Suctioning using a Suction Catheter

5. Occlude the thumb control valve on the catheter and slowly & gently withdraw the catheter from the mouth or nostril
   - Use a 360^0 rotation (spiral) motion until the catheter is completely removed
6. Rinse catheter by suctioning sterile water and repeat the procedure
7. Suction for 10 seconds then allow the baby 30 seconds to breath.

- **Insert suction catheter to marked depth**
- **Do not suction too vigorously.**
- **Do not suction too long!**
- **Observe suctioned contents carefully**
- **Empty suction machine reservoir if ¾ full.**

Breathing

Breathing assessment

- Look at the chest
  - Chest movement?
- Listen for breath sounds
  - Noises of breathing?
- Feel for air on your cheek
  - Air movement?

Image borrowed from http://nch.adam.com/content.aspx?productId=117&pid=1&gid=000011

Breathing during neonatal resuscitation

1

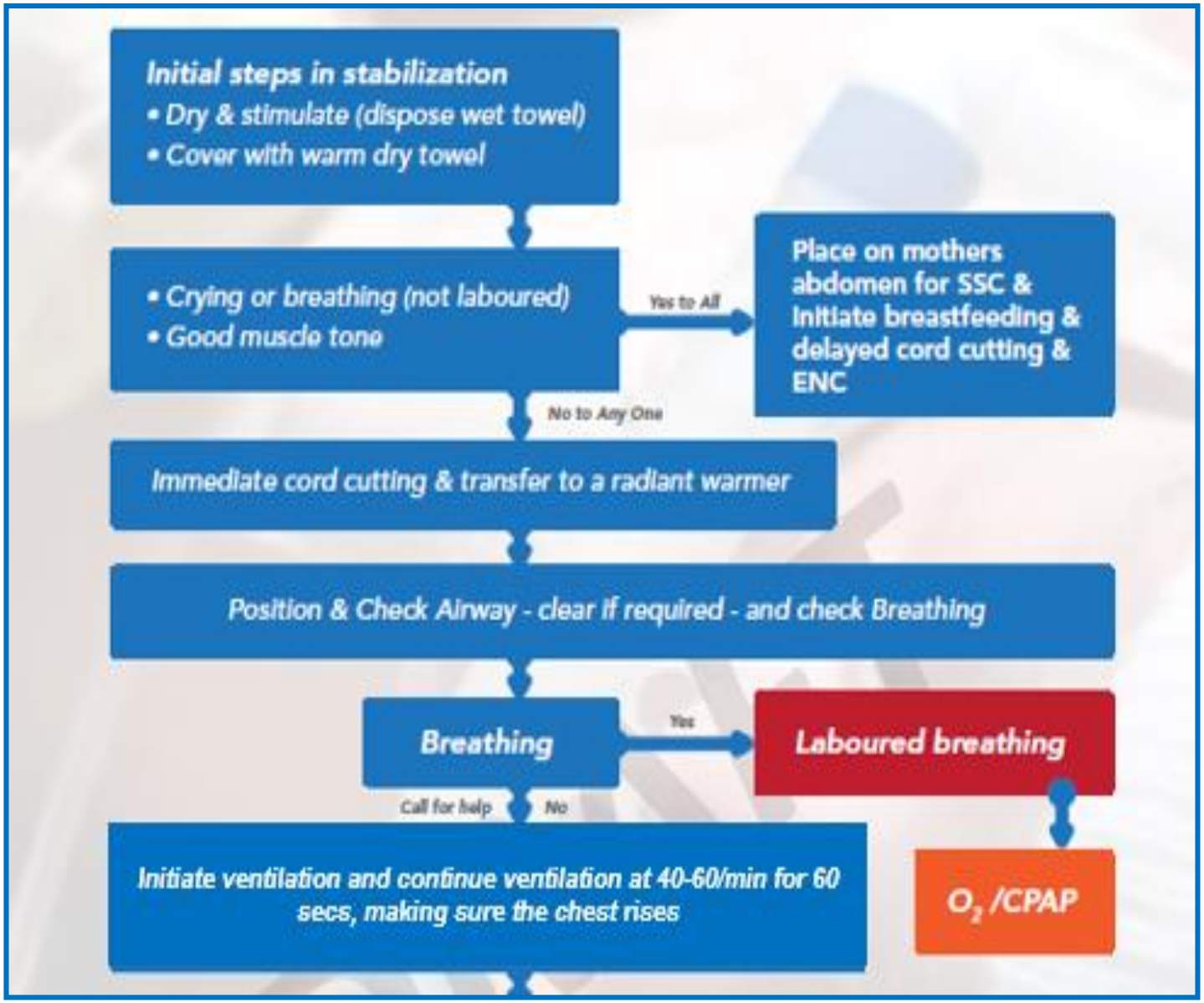
2

About 5% of newly born infants do not breath, and hence ventilation should be initiated.

Ventilation of the baby's lungs is the most important and effective action during neonatal resuscitation.

Part 7: neonatal resuscitation: 2015 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations.Circulation. 2015;132(suppl 1):
Image from https://parenting.firstcry.com/articles/benefits-of-normal-delivery-for-mom-and-baby/

Newborn resuscitation



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Ventilation equipment for the first one minute

Bag, Valve and Mask device

Room air (21%)

Reduction of mortality by 27% using room air compared to 100% oxygen

Clock for timing - 1 min

Images from 1. Resuscitation and stabilization of babies born preterm. In: Weiner GM, Zaichkin J, eds. Textbook of Neonatal Resuscitation. 7th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2016:225–241

1. NEST 360

BVM parts

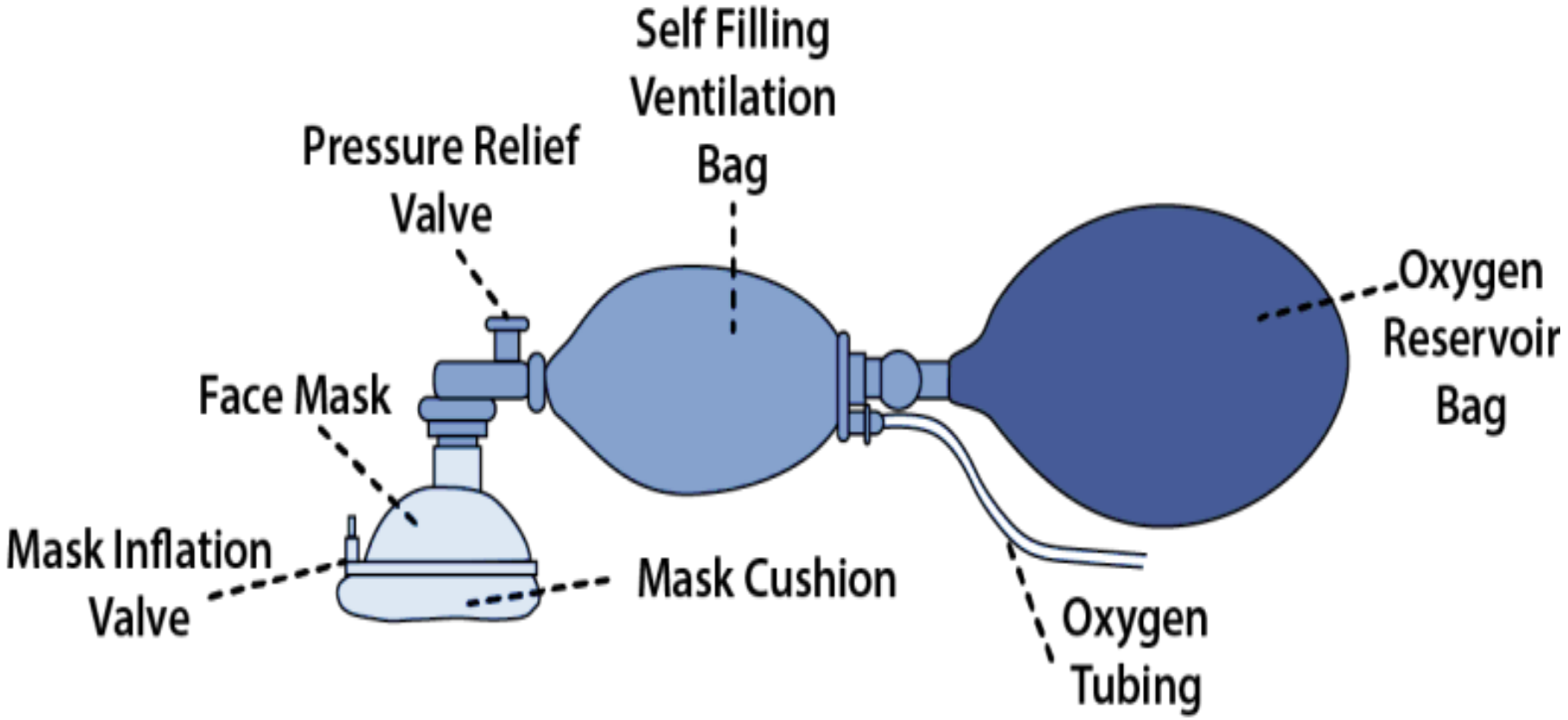


Image from https://airwayjedi.com/2017/03/26/manual-ventilation-self-inflating-vs-free-flow-bag/

Steps /sequence of ventilation

Figure 4.8. Position yourself at the baby's head to provide assisted ventilation.

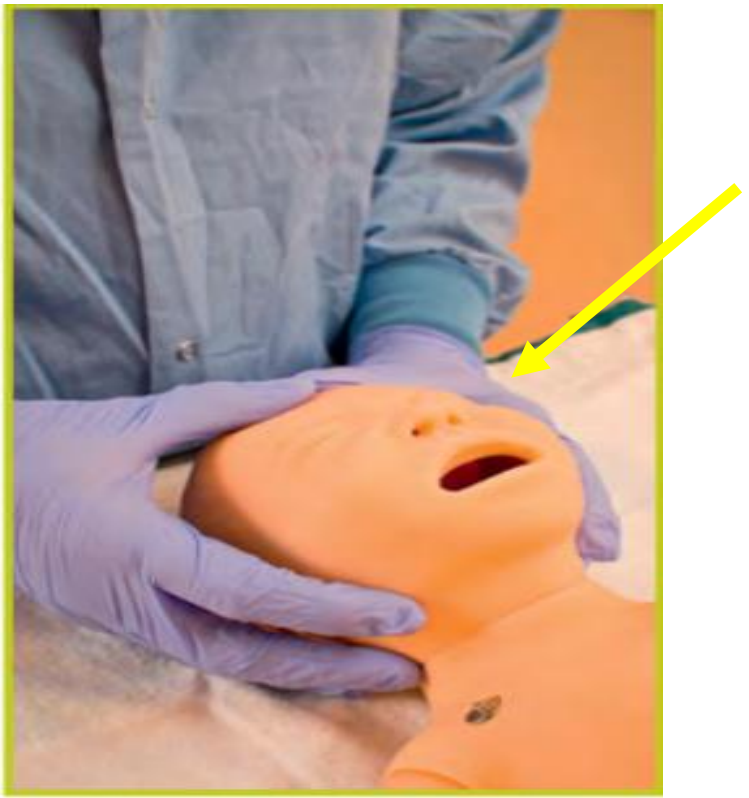
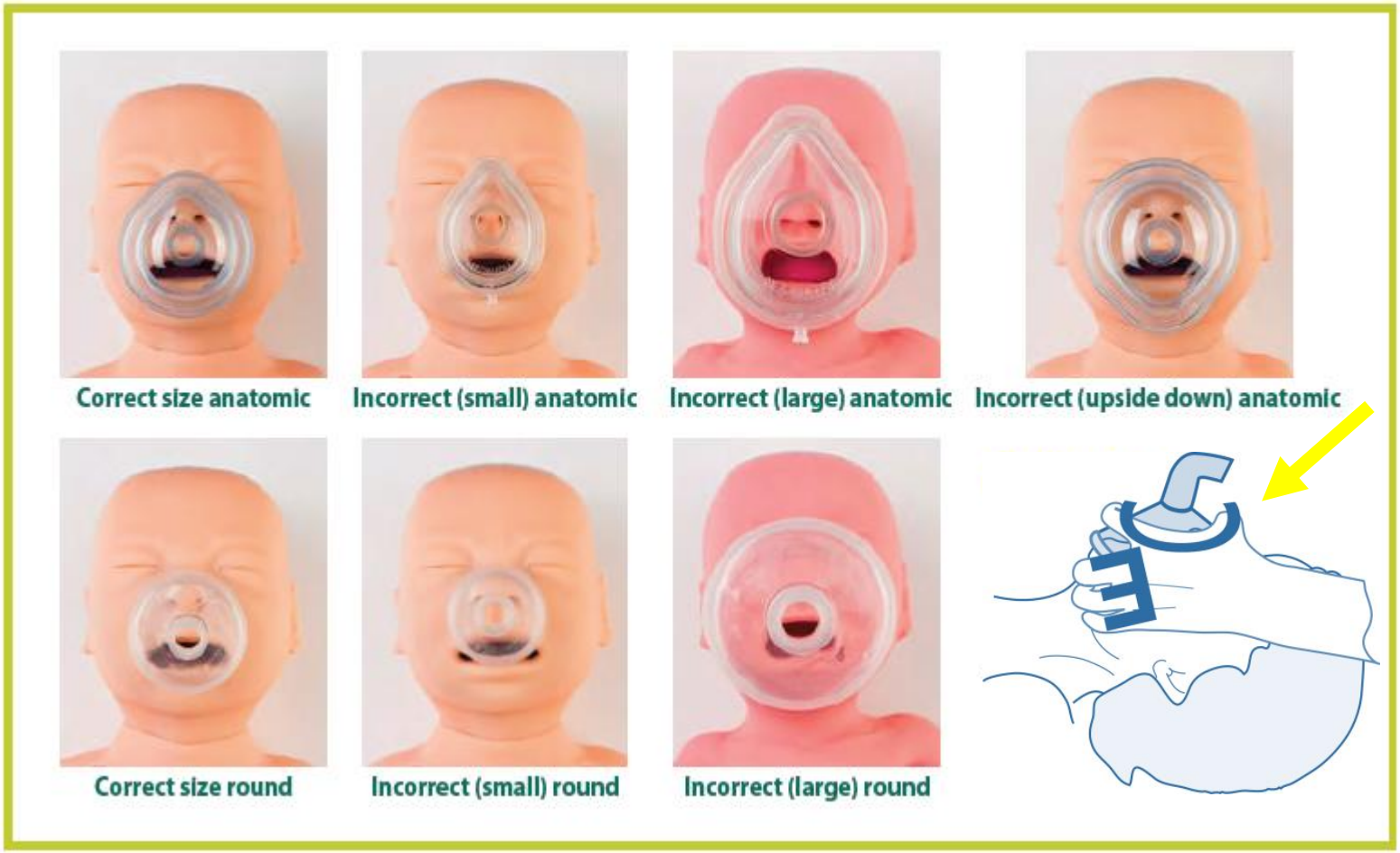


Figure 4.9. The sniffing position

Image from Resuscitation and stabilization of babies born preterm. In: Weiner GM, Zaichkin J, eds. Textbook of Neonatal Resuscitation. 7th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2016:225–241

Mask sizing and C-E Grip



Resuscitation and stabilization of babies born preterm. In: Weiner GM, Zaichkin J, eds. Textbook of Neonatal Resuscitation. 7th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2016:225–241

Essentials in helping babies breath / Bagging

- **40-60 ventilations/min[1]**
- Adequate chest rise[1]

Initial Inflation pressure (PIP)

- **20cm H_2O[1]** for pre-terms and
- **30 cmH_2O** for term babies

- Room air(21%)[2,3]

Heart rate is the most important indicator of effective ventilation

1. 2010 American Heart Association Guidelines for CardiopulmonaryResuscitation and Emergency Cardiovascular Care
2.Welsford M, Nishiyama C, Shortt C, et al. Room Air for Initiating Term Newborn Resuscitation: A Systematic Review With Meta-analysis. Pediatrics. 2019;143(1):e20181825
3. Welsford M, Nishiyama C, Shortt C, et al. Initial Oxygen Use for Preterm Newborn Resuscitation: A Systematic Review With Meta-analysis. Pediatrics. 2019;143(1):e20181828
4.WHO Guidelines on Basic Newborn Resuscitation 2012

Ventilation – 40-60/min

Breath one two

Breath one two

Breath one two

Breath one two

Images from Resuscitation and stabilization of babies born preterm. In: Weiner GM, Zaichkin J, eds. Textbook of Neonatal Resuscitation. 7th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2016:225–241https://clinicalgate.com/pediatric-emergencies-and-resuscitation/

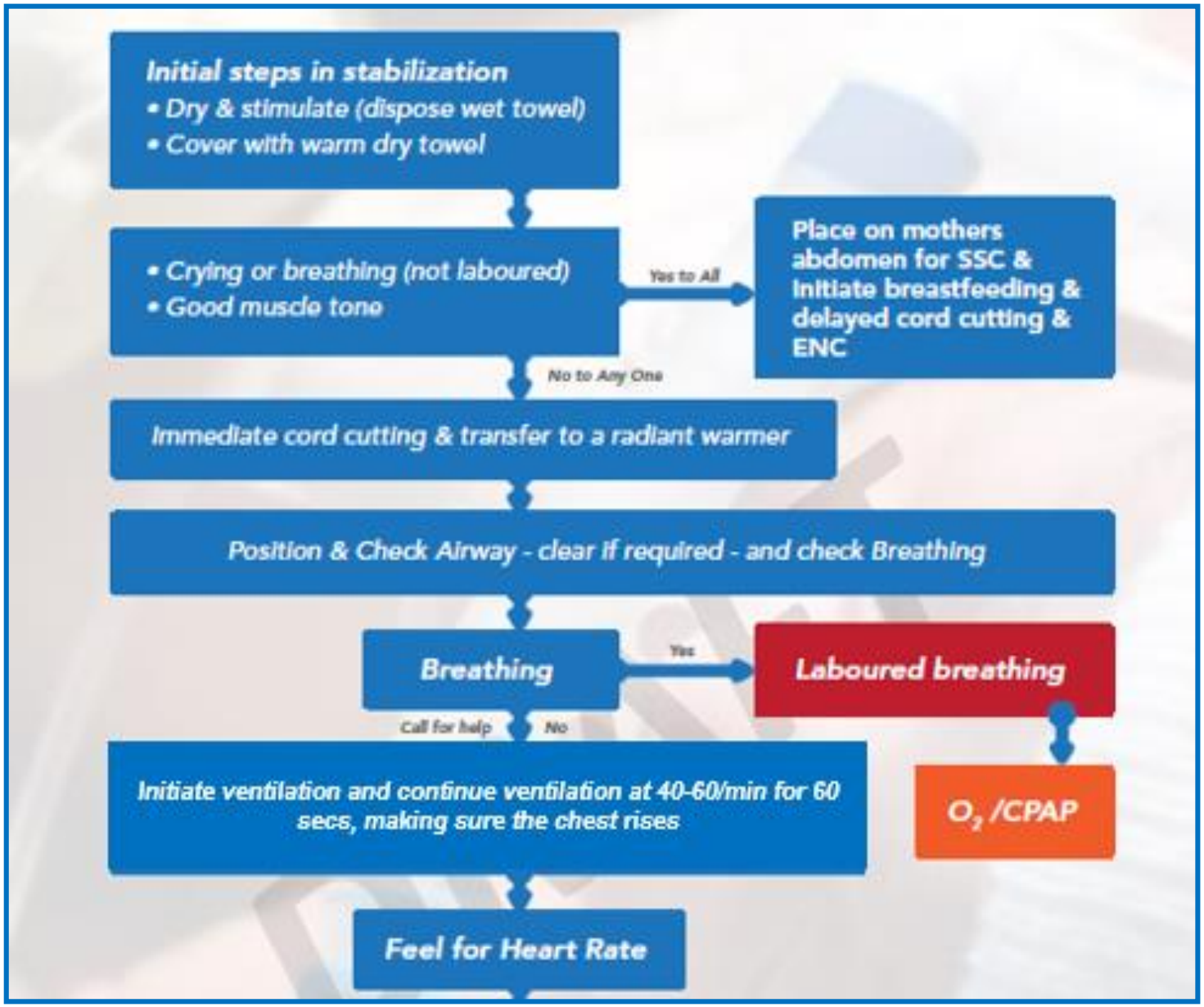
The 6 Corrective ventilation steps

	Actions
M	Adjust **Mask** to assure good seal on the face
R	**Reposition** airway by adjusting head to "sniffing position
S	**Suction** mouth and nose of secretions, if present
O	**Open** mouth slightly and move jaw forward
P	Increase **Pressure** to achieve chest rise
A	Consider **Airway** alternative (endotracheal intubation or laryngeal mask airway)

Resuscitation and stabilization of babies born preterm. In: Weiner GM, Zaichkin J, eds. Textbook of Neonatal Resuscitation. 7th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2016:225–241

Circulation

Newborn resuscitation

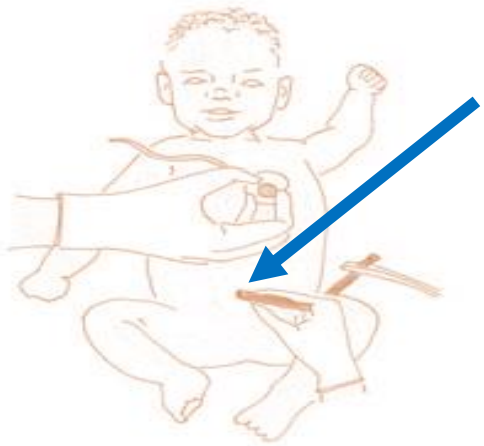


Circulation

- Assess heart rate

Umbilical cord

1

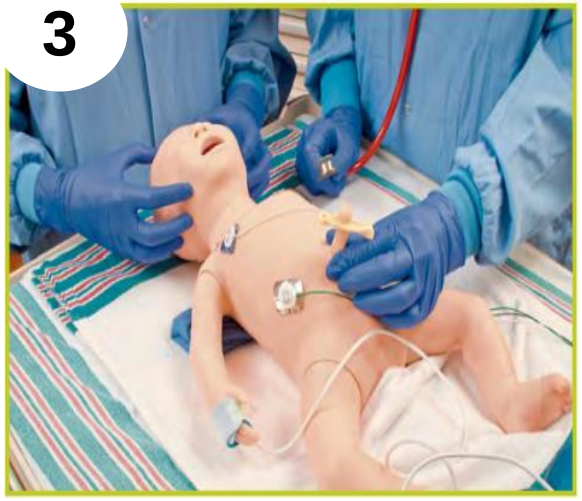


Stethoscope

2

Pulse oximeter/ECG

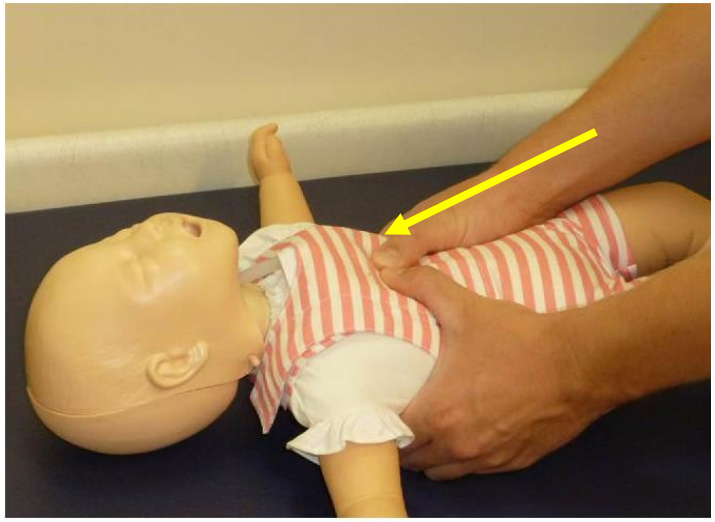
3

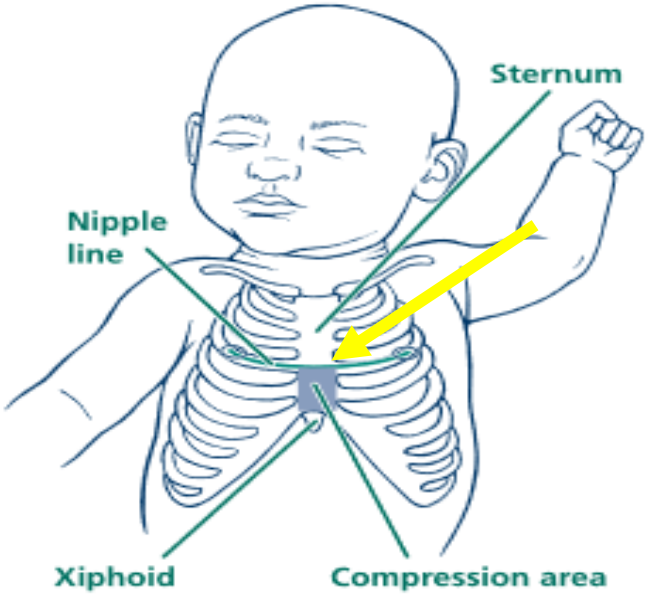


- Count HR over 5-10 seconds
- If estimated to be below 60/min- provide chest compression
- Initiate chest compressions only if 2nd rescuer available- ventilation should not be interrupted to provide compressions

Images borrowed from Neonatal Resuscitation2015 American Heart Association Guidelines Update forCardiopulmonary Resuscitation and EmergencyCardiovascular Care and https://moodle.digital-campus.org/mod/page/view.php?id=12292
WHO 2012 recommendations on neonatal resuscitation

Principles of Chest compressions





- Two thumb encircling technique
- **Compression Rate** 3:1
- **Location**: lower third of the sternum
- **Achieve**- 1/3rd of the anteroposterior diameter
- **Minimize interruptions**- reduces coronary artery perfusion
- Use 100% oxygen when starting chest compressions

Image borrowed from https://www.semanticscholar.org/paper/Cardiopulmonary-resuscitation-(CPR)-related-rib-in-Franke Pingen/b69fc74ba1e10861c8dd68f7b99f76779e28e85a/figure/0
Neonatal Resuscitation2015 American Heart Association Guidelines Update forCardiopulmonary Resuscitation and EmergencyCardiovascular Care

Why use 2 thumb encircling method?

Preferred over the two finger method

- Consistent depth and force
- Higher peak systolic and coronary perfusion pressure
- Good blood supply in the circulation
- Less rescuer fatigue
- More likely to achieve correct anatomical placement

1. Jiang J, Zou Y, Shi W, Zhu Y, Tao R, Jiang Y, Lu Y, Tong J. Two-thumb-encircling hands technique is more advisable than 2-finger technique when lone rescuer performs cardiopulmonary resuscitation on infant manikin. American journal of emergency medicine 2015; 33(4): 531-534.

2. Two-thumb-encircling advantageous for lay responder infant CPR: a randomised manikin study Pellegrino JL, Bogumil D, Epstein JL, Burke RV, Archives of disease in childhood, 2019, 104(6), 530-534 |https://doi.org/10.1136/archdischild-2018-314893

3. 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care John Kattwinkel, Co-Chair; Jeffrey M. Perlman, Co-Chair*; Khalid Aziz;. Image borrowed from Pals Provider manual 2015*

Value of Effective Chest compressions

- Compression rate 3:1
- Aim at 120 events (90 compressions+30 ventilations)
- Achieving depth- 1/3 anteroposterior diameter
- Allow for chest recoil
- Minimize interruption

Adequate systolic and coronary pressures

Ensures blood supply to all essential organs e.g Heart, Brain and Kidney

Coronary perfusion important indicator of return to circulation (ROSC) and neurologic outcome

1. Two-thumb-encircling advantageous for lay responder infant CPR: a randomised manikin study Pellegrino JL, Bogumil D, Epstein JL, Burke RV, Archives of disease in childhood, 2019, 104(6), 530-534 |https://doi.org/10.1136/archdischild-2018-314893

2.. 201 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care John Kattwinkel, Co-Chair; Jeffrey M. Perlman, Co-Chair*; Khalid Aziz*

Updates on guidelines for babies born through Meconium

Evolution of the guidelines regarding Meconium

1970
- Practice was to suction once the head was delivered, and Intratracheal suctioning

1988
- Faciglia *et al* showed the incidence of MAS in those suctioned vs those not was comparable

2004
- Large multicenter prospective randomized trial concluded a comparable incidence of MAS

2005
- Guidelines change was suggested but not implemented due to various controversies and failure of the experts to agree.

2010
- Guideline change implemented

Routine suctioning of babies born through meconium stained amniotic fluid was being practiced

Routine suctioning of babies born through meconium stained amniotic fluid should not be done

Whitfield, J. M., Charsha, D. S., & Chiruvolu, A. (2009). Prevention of meconium aspiration syndrome: an update and the Baylor experience. Proceedings (Baylor University. Medical Center), 22(2), 128–131. https://doi.org/10.1080/08998280.2009.11928491

Emerging evidence regarding suctioning meconium

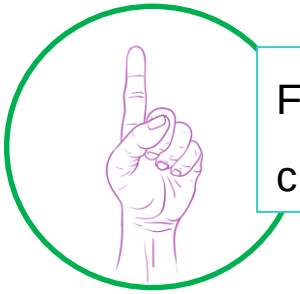
No difference in incidence of :

- Meconium aspiration syndrome (MAS)
- Need for oxygen / respiratory support
- Development of complications
- Mortality

This applies to oral, nasopharyngeal and endotracheal suctioning of babies born through meconium stained liquor

Outcomes of endotracheal suctioning in non-vigorous neonates born through meconium-stained amniotic fluid: a systematic review and meta-analysis Nanthida Phattraprayoon, Wimonchat Tangamornsuksan, Teerapat Ungtrakul 2020
Effect of intrapartum oropharyngeal (IP-OP) suction on meconium aspiration syndrome (MAS) in developing country: a RCTResuscitation, 2015, 97, 83-87 | added to CENTRAL: 29 February 2016 | 2016 Issue 2 https://doi.org/10.1016/j.resuscitation.2015.09.394 Nangia S, Pal MM, Saili A, Gupta U
Kumar A, Kumar P, Basu S. Endotracheal suctioning for prevention of meconium aspiration syndrome: a randomized controlled trial. Eur J Pediatr. 2019;178(12):1825-1832. doi:10.1007/s00431-019-03463-z

Current recommendation regarding meconium



Focus is on initial stabilization i.e. drying, stimulation, checking airway and initiation of ventilation if required

Routine oral and nasopharyngeal suctioning in babies born through meconium stained fluid **not recommended**

Routine tracheal suctioning in babies born through meconium stained fluid **not recommended**

Neonatal Resuscitation2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

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What about meconium?

Baby born through meconium stained liquor
Initial stabilization- drying and stimulation,

Active, good respiratory effort and good muscle tone

Initial steps of newborn care. SSC

- IVF/EBM & blood sugars 2hrs after birth,
- Keep warm maintain 36.5-37.5^{0}C
- Vit K, cord care, eye care
- Treat infections if indicated
- Family Centered Care

Poor muscle tone, no cry and inadequate breathing efforts

Radiant warmer
initial steps of resuscitation,

Positive pressure ventilation -if the infant is not breathing

Intubation and direct suctioning if chest not rising(**only for experienced personnel !!!**)

Neonatal Resuscitation2015 American Heart Association Guidelines Update forCardiopulmonary Resuscitation and EmergencyCardiovascular Care

Target oxygen saturations

Target oxygen levels after birth

Time after birth	Oxygen saturation
2min	55-75%
3min	65-80%
4min	70-85%
5min	80-90%
10minutes	85-95%

Adjust oxygen flow every 60 seconds to achieve target SpO_2 levels- only for blended oxygen

In our setting-Change of mode of oxygen delivery and flow rate from the source

Resuscitation and stabilization of babies born preterm. In: Weiner GM, Zaichkin J, eds. Textbook of Neonatal Resuscitation. 7th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2016:225–241
Neonatal Resuscitation2015 American Heart Association Guidelines Update forCardiopulmonary Resuscitation and EmergencyCardiovascular Care

Value of pulse oximetry

- **Oxygen target of 90-95%**

- Use of pulse oximetry
  - Resuscitation is anticipated
  - Confirm persistent central cyanosis
  - Supplemental oxygen is administered
  - Positive-pressure ventilation is required
- **Preductal values-** Better estimate of coronary artery saturations-
- **Right upper extremity-** wrist or medial surface of the palm

Resuscitation and stabilization of babies born preterm. In: Weiner GM, Zaichkin J, eds. Textbook of Neonatal Resuscitation. 7th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2016:225–241
Neonatal Resuscitation2015 American Heart Association Guidelines Update forCardiopulmonary Resuscitation and EmergencyCardiovascular Care

How to deliver oxygen?

Bag and valve device

Delivers 100% oxygen

Indications:

- Did not cry at birth & if chest compressions are required
- Apnea
- Gasping(not effective)

Non-Rebreather mask

Delivers 85-100% oxygen

Indications:

- Post resuscitation
- If breathing but not able to attain target SpO_2 at lower FiO_2

Nasal prongs

Delivers 30-45% oxygen

Indications

- Labored breathing and patient is able to meet target SpO_2 using this FiO_2
- **If develops apnea/ gasping- PPV using Bag and valve device**

Use of drugs during resuscitation

Use of Drugs in Newborn resuscitation

- Most newborns improve without emergency medications.
- Before considering drugs, assess effectiveness of ventilation and compressions
- Drugs indicated if bradycardia persists despite:
  - **Optimal ventilation**
  - **Effective chest compressions**
  - **Endotracheal intubation**
- Consider use of epinephrine +/- use of volume expanders
- Consider blood transfusion if blood loss is established

Naloxone, sodium bicarbonate, aminophylline hydrocortisone and 50% dextrose not recommended

Resuscitation and stabilization of babies born preterm. In: Weiner GM, Zaichkin J, eds. Textbook of Neonatal Resuscitation. 7th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2016:225–241

Using the Radiant Warmer

The Radiant Warmer

Placing a newly born (who requires resuscitation) under a prewarmed radiant warmer uncovered;

1. Permits the radiant heat to reach the baby
2. Allows full visualization
3. Allows easy access to the baby without excessive heat loss

Bensouda B.; Mandel R.; Mejri A.; Lachapelle J.; St-Hilaire M.; Ali N.; (2018) Temperature Probe Placement during Preterm Infant Resuscitation: A Randomized Trial; Neonatology 113:27–32 DOI: 10.1159/000480537
Weiner GM, Zaichkin J, Kattwinkel J (eds): Textbook of Neonatal Resuscitation, ed 7. Elk Grove Village, American Academy of Pediatrics, 2016

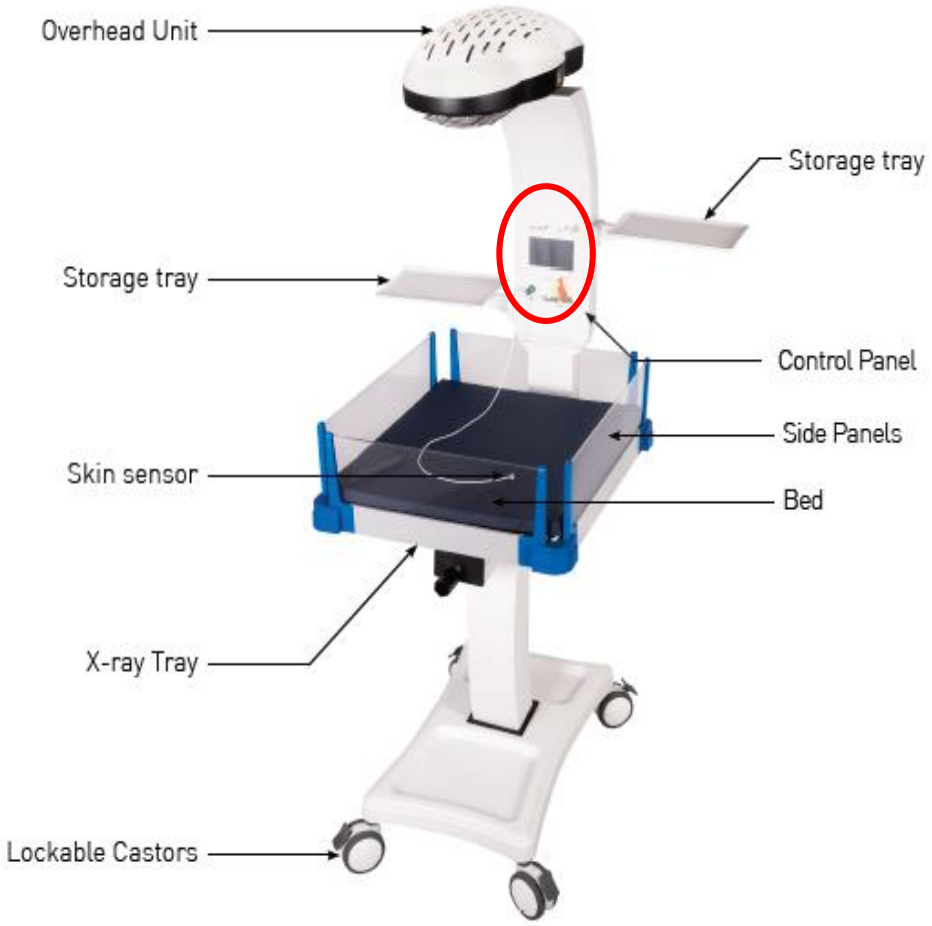
The Radiant Warmer - Caution

All preterms require strict temperature regulation & monitoring while under the radiant warmer during resuscitation

For asphyxiated babies, switch off the heat of the radiant warmer & maintain room temperature

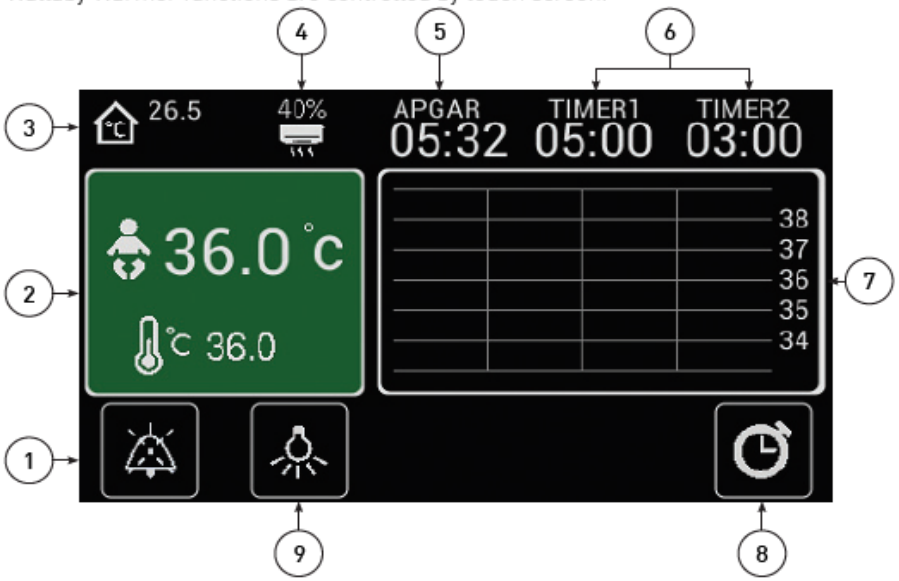
Bensouda B.; Mandel R.; Mejri A.; Lachapelle J.; St-Hilaire M.; Ali N.; (2018) Temperature Probe Placement during Preterm Infant Resuscitation: A Randomized Trial; Neonatology 113:27–32 DOI: 10.1159/000480537
Weiner GM, Zaichkin J, Kattwinkel J (eds): Textbook of Neonatal Resuscitation, ed 7. Elk Grove Village, American Academy of Pediatrics, 2016.

The Radiant Warmer



Control Panel

Wallaby Warmer functions are controlled by touch screen.



1	**Alarm Mute**	Touch this symbol to mute the alarm for 10 minutes
2	**MODE Selection Panel**	Displays set values and actual values in different MODES Touch this panel to select operational modes (MANUAL, BABY, PREWARM)
3	**Ambient Temperature**	Displays ambient temperature in °C
4	**Heater Power**	Displays heater power
5	**APGAR Timer**	Displays APGAR Timer
6	**Procedure Timer**	Displays Procedure Timers
7	**Temperature History Chart**	Displays 5 minute Set Temperature and Baby Temperature history
8	**Timer**	Touch this symbol to enter APGAR and Procedure Timers selection screen
9	**Examination Light**	Touch this symbol to enter light adjustment screen

Wallaby radiant warmer user manual (2019) www.mtts-asia.com

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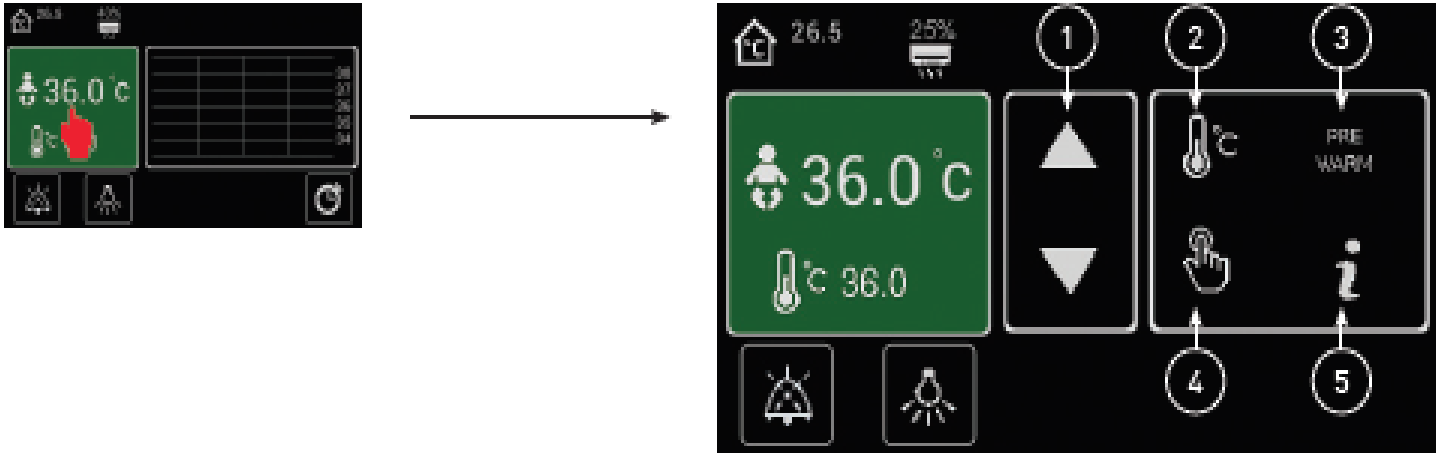
The Radiant Warmer - Modes

Touch MODE Selection panel to enter MODE Selection screen

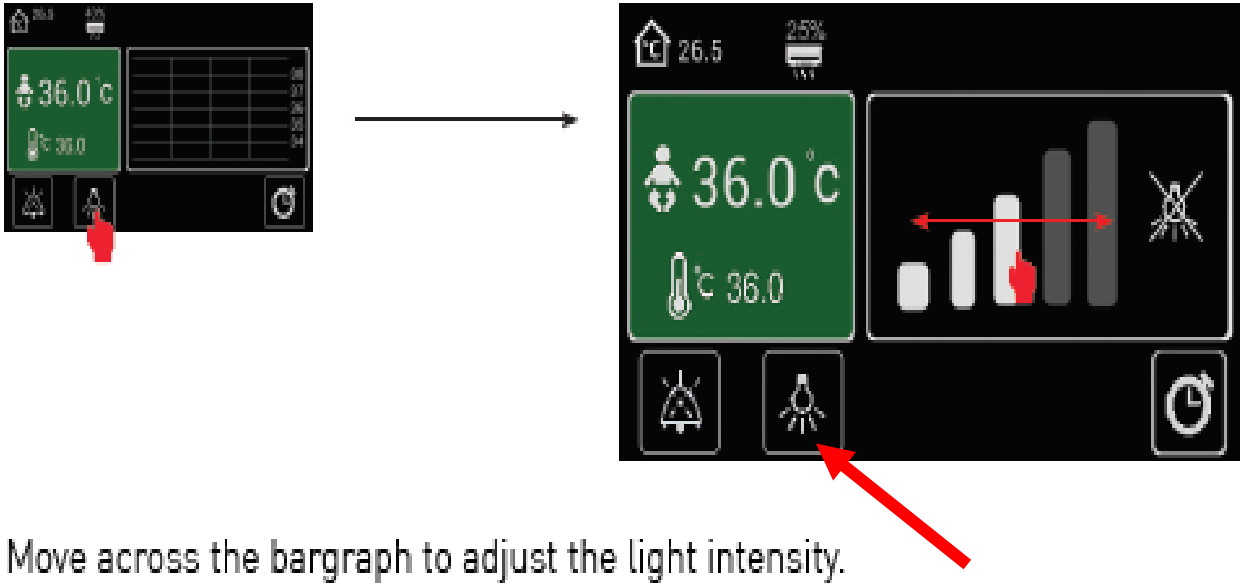


1	**Set value adjustment**	Touch the arrow up or down to adjust set temperature or heater power
2	**BABY MODE**	Touch this symbol to select BABY MODE
3	**PREWARM MODE**	Touch this symbol to select PREWARM MODE
4	**MANUAL MODE**	Touch this symbol to select MANUAL MODE
5	**Information**	Touch this symbol to display information about the device

The Radiant Warmer – Lights

Examination Light

Touch Examination Light symbol to enter light adjustment screen



Move across the bargraph to adjust the light intensity.

The device will come back to original screen after 3 seconds.

The Radiant Warmer - Alarms

Alarm System

All the alarms are displayed on the Mode Selection Panel

Alarm	Mode	Cause	Effect	Mute Button
HIGH SKIN TEMP 	BABY	Measured skin temperature higher than set temperature by 1°C	Heater power disabled	Silences audible alarm only
	MANUAL	Measured skin temperature higher 38°C	Heater power disabled	Silences audible alarm only
	PREWARM	Not active	Not active	Not active
LOW SKIN TEMP 	BABY	Measured skin temperature lower than set temperature by 1°C	Heater reduced to 25% of power	Cancels alarm and restores heater power
	MANUAL	Not active	Not active	Not active
	PREWARM	Not active	Not active	Not active
SENSOR DISCONNECT 	BABY	Skin sensor unplugged or faulty	Heater reduced to 25% of power	Silences audible alarm only
	MANUAL	Not active	Not active	Not active
	PREWARM	Not active	Not active	Not active
POWER FAILURE 	ALL	Power supply to Warmer failed	Warmer disabled	Silences audible alarm only
ERROR 	ALL	Software or hardware failure (refer to Service Manual for more information on error codes)	Warmer disabled	Silences audible alarm only

Wallaby radiant warmer user manual (2019) www.mtts-asia.com

The Radiant Warmer - Preparation

1. Know the type of radiant warmer, its parts and how to use them

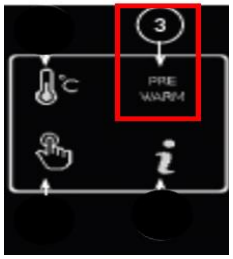
2. Assemble all necessary items for resuscitation

3. Lock the radiant warmer castors to secure it in place

4. Observe hand hygiene and wear PPE

5. Clean temperature probe with 70% alcohol and attach to warmer

6. Switch the warmer on and select Prewarm mode



Bensouda B.; Mandel R.; Mejri A.; Lachapelle J.; St-Hilaire M.; Ali N.; (2018) Temperature Probe Placement during Preterm Infant Resuscitation: A Randomized Trial; Neonatology 113:27–32 DOI: 10.1159/000480537 & Wallaby radiant warmer user manual (2019) www.mtts-asia.com

The Radiant Warmer – Probe Use

Babies who are not crying, not breathing and have poor muscle tone should be transferred ***immediately to the radiant warmer & resuscitation begun***

1. Attach and secure the temperature probe at the correct position
   - **Locate the right mid-clavicle and draw an imaginary vertical line downwards**
   - **Locate the xiphisternum and draw an imaginary horizontal line towards the right side**
   - **Where the 2 lines meet at 90⁰ (over the liver), place & secure the temperature probe skin sensor**
2. Select the Baby mode/Servo mode/Automatic mode
3. Maintain Temperature between 36.5⁰C – 37.5⁰C

Bensouda B.; Mandel R.; Mejri A.; Lachapelle J.; St-Hilaire M.; Ali N.; (2018) Temperature Probe Placement during Preterm Infant Resuscitation: A Randomized Trial; Neonatology 113:27–32 DOI: 10.1159/000480537 & Weiner GM, Zaichkin J, Kattwinkel J (eds): Textbook of Neonatal Resuscitation, ed 7. Elk Grove Village, American Academy of Pediatrics, 2016.

Use of plastic wraps for preterms <32 weeks

Use of Plastic Bags/Wraps For Preterm - Requirements

- Polyethylene paper/wrap
    a. **Transparent**
    b. **Low density polythene (saran)**
    c. **At least 50cm wide**
- Cord clamp
- Hat
- Stethoscope
- Radiant warmer
- PPE

Image source: https://bit.ly/3eC2r6W
Heat Loss Prevention: A Systematic Review of Occlusive Skin Wrap for Premature Neonates Kristie Cramer et al (2005)

Procedure

1. When possible ensure parents are informed of the procedure and the concept behind the use of the bag.
2. Ensure the delivery room is at least 25°C and draught free
3. Place occlusive plastic wrap over the bed of the prewarming resuscitaire (approximately the width of the resuscitaire)
4. **Do not allow plastic to over heat.**

25^{0}C

Image source: https://bit.ly/3eC2r6W

Heat Loss Prevention: A Systematic Review of Occlusive Skin Wrap for Premature Neonates Kristie Cramer et al (2005

Procedure

4. Receive the infant & Place on the occlusive plastic wrap **without drying** the baby and fold wrap over the infant covering the entire body **excluding the head.**
5. **Dry the head and put the hat.**
6. Perform clinical assessment and resuscitation interventions through the bag.
7. Attach temperature probe skin sensor and **monitor temperature & other vitals**

8. Remove the plastic wrap/bag only after the newborn is shifted to nursery and is stabilized within 1 - 2hrs.

Image source: https://bit.ly/3eC2r6W
Heat Loss Prevention: A Systematic Review of Occlusive Skin Wrap for Premature Neonates Kristie Cramer et al (2005

Infection Prevention & Control

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Infection Prevention & Control

Non-critical patient care items

- Items which come in to contact with **patient's intact skin**
- Low level disinfection with 0.05% sodium hypochlorite - Non metallic items
- High level disinfection with 70% alcohol - Metallic items

Semi-critical patient care items

- Items which come in to contact with **patient's mucosa and non intact skin (non sterile body parts)**
- Discard suction catheter, bulb sucker
- High level disinfection with 0.5% sodium hypochlorite - Suction machine reservoir & its tubings
- Autoclave - Linen, Penguin suckers, BVM

Trevor Duke (2014) CPAP: a guide for clinicians in developing countries, Paediatrics and International Child Health, 34:1, 3-11, DOI: 10.1179/2046905513Y.0000000102
Anna M. Bonner & Petra Davidson (2020) Infection Prevention: 2020 Review and Update for Neurodiagnostic Technologists, The Neurodiagnostic Journal, 60:1, 11-35, DOI:10.1080/21646821.2020.1701341

Summary & take home message

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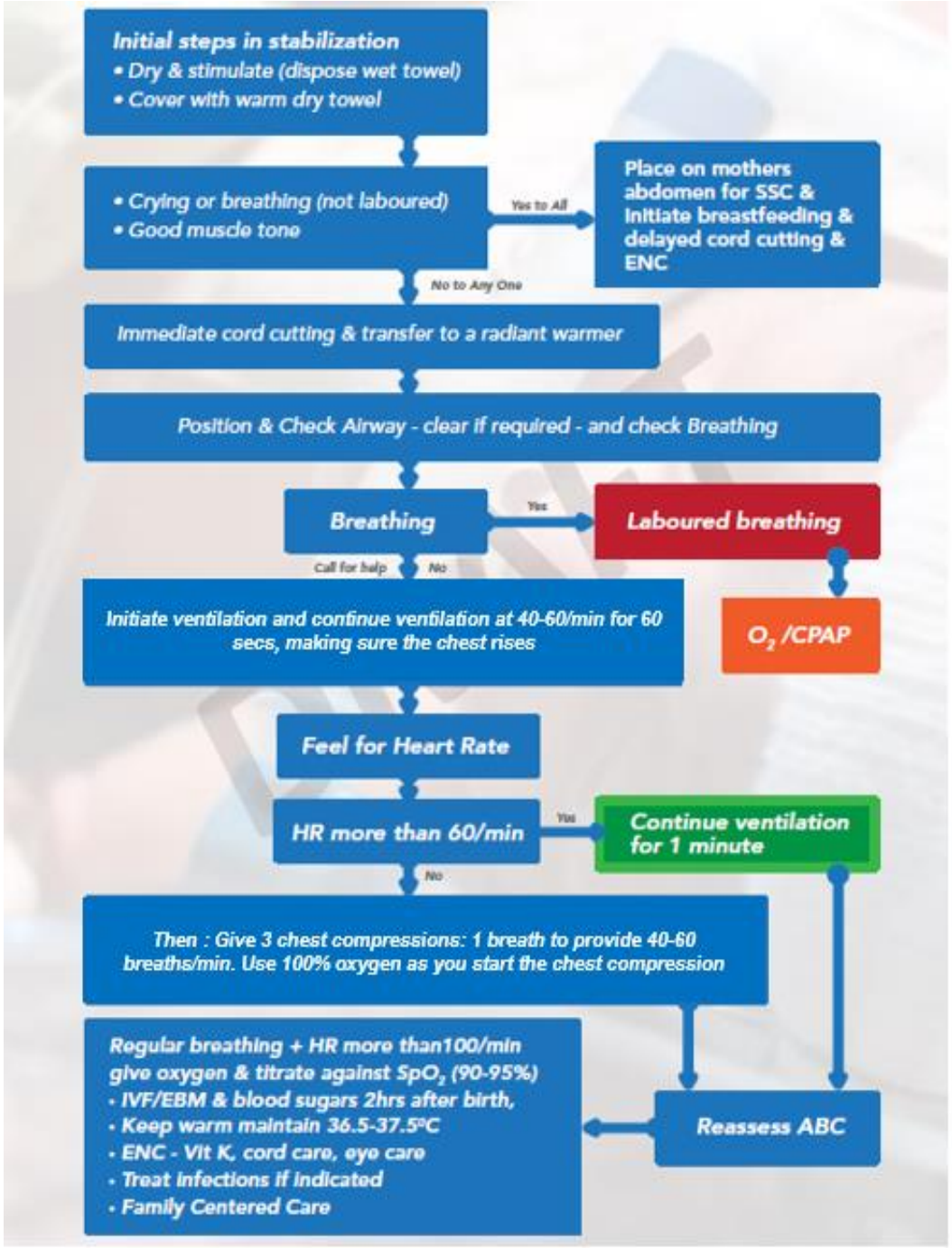
Emergency Triage Assessment and Treatment plus admission

Summary


REPUBLIC OF KENYA
MINISTRY OF HEALTH
Comprehensive Newborn Care Protocols
Integrating Technologies with Clinical Care
Keprecon
KEMRI Wellcome Trust
KENYA PAEDIATRIC ASSOCIATION
CENTER FOR PUBLIC HEALTH & DEVELOPMENT
NEST360


Initial steps in stabilization
• Dry & stimulate (dispose wet towel)
• Cover with warm dry towel
• Crying or breathing (not laboured)
• Good muscle tone
Yes to All
Place on mothers abdomen for SSC & Initiate breastfeeding & delayed cord cutting & ENC
No to Any One
Immediate cord cutting & transfer to a radiant warmer
Position & Check Airway - clear if required - and check Breathing
Breathing
Yes
Laboured breathing
Call for help
No
Initiate ventilation and continue ventilation at 40-60/min for 60 secs, making sure the chest rises
O_2 /CPAP
Feel for Heart Rate
HR more than 60/min
Yes
Continue ventilation for 1 minute
No
Then : Give 3 chest compressions: 1 breath to provide 40-60 breaths/min. Use 100% oxygen as you start the chest compression
Regular breathing + HR more than100/min
give oxygen & titrate against SpO_2 (90-95%)
• IVF/EBM & blood sugars 2hrs after birth,
• Keep warm maintain 36.5-37.5°C
• ENC - Vit K, cord care, eye care
• Treat infections if indicated
• Family Centered Care
Reassess ABC