The Febrile Infant / Child With Acute Illness And Altered Consciousness

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Emergency Triage Assessement and Treatment plus admission

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Kenya Paediatric Research Consortium

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Objectives

1. Assessment and diagnosis of altered consciousness: meningitis and severe malaria
2. Who needs an LP?
3. Drugs for Acute Bacterial meningitis a***ge >*** ***1m*** *(TB meningitis not covered)*
4. What is cerebral malaria / severe malaria
5. Use of Artesunate & Quinine

What is wrong with this child?

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Newer vaccines (HiB and Pneumo) and increased use of bednets are changing disease pattern

Cerebral Malaria

Abscess / TB

Encephalitis

Acute Bacterial Meningitis

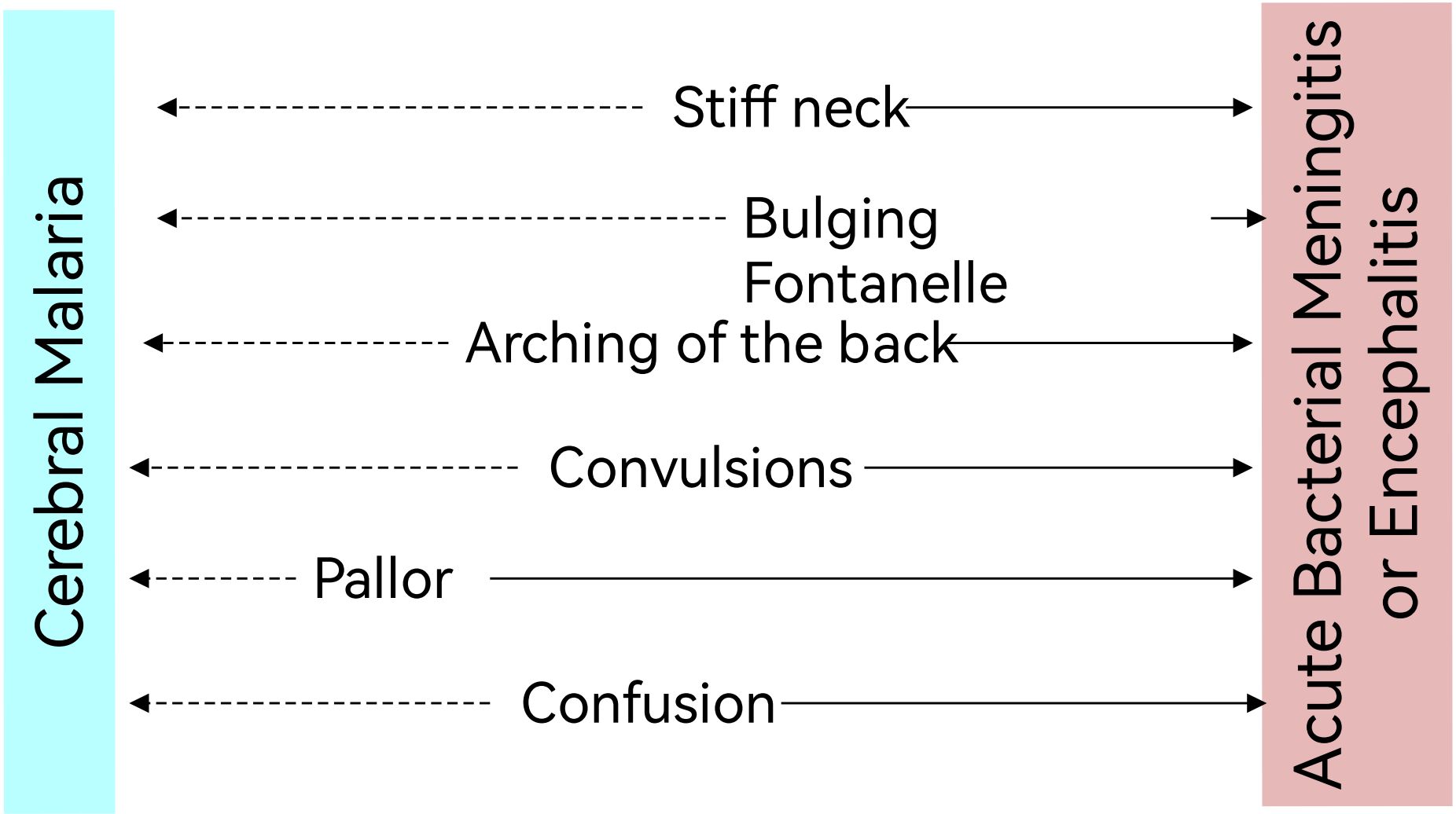
Primary or secondary complication of severe systemic illness or HIV

How severe is the problem?

- Severity and duration of symptoms
- Convulsions (duration, type & frequency)
- Ability to feed?

A	Alert	Eye contact
V	Responds to Voice	Carer's call - name
P	Responds to Pain	Over sternum - Localises
U	Unconscious	Inappropriate response to pain

CM vs ABM vs Encephalitis



Clinically you cannot make a certain diagnosis – Lumbar puncture and malaria test are critical

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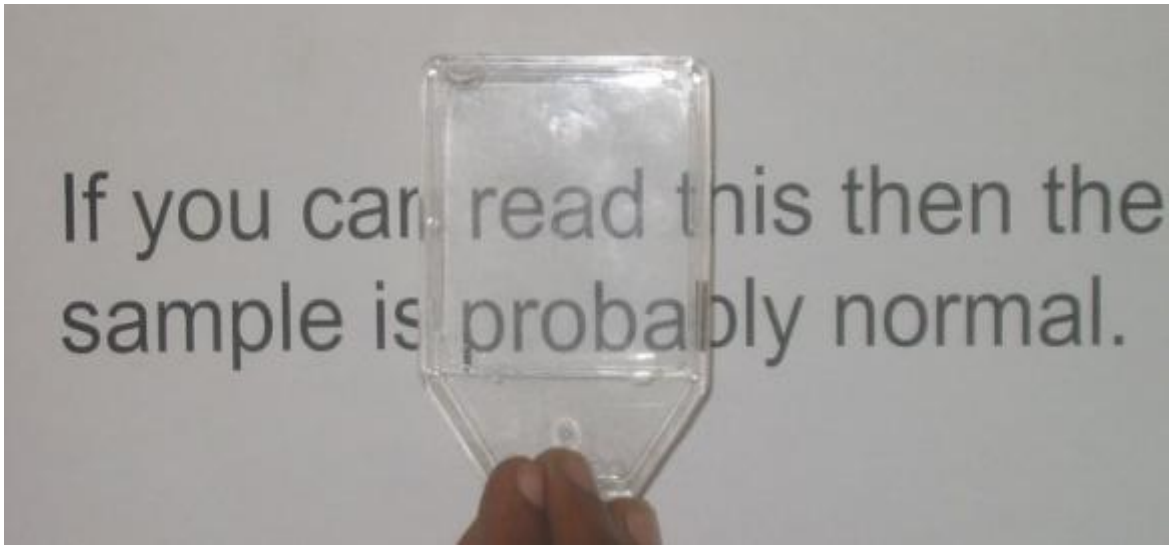
So what is a sensible rule for LP?

- At a minimum, if you want to avoid missing meningitis (and deaths and handicap from it), **and avoid wasting antibiotics**, at least LP those with history of fever and one of:
  - Bulging fontanelle
  - Stiff neck
  - Fits if age <6 months or > 6 yrs
  - Partial or focal fits
  - Reduced consciousness

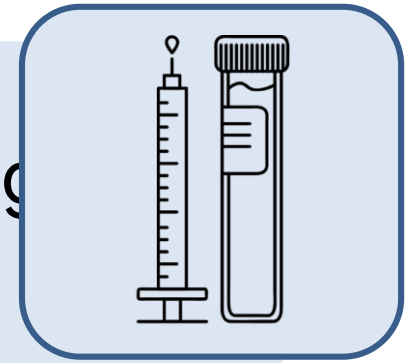
CSF Cloudiness / Turbidity



CSF should be crystal clear.

Cloudiness usually appears at CSF WBC counts > $200x10^6$ Wbc per L

A well run hospital can....



- Get LPs done on admission before starting treatment
- ***Get CSF to the laboratory immediately*** (do not put CSF in fridge or incubator)
- Do a count of the CSF white cells (and their type) within 1 hour of receiving the sample
- Ideally do a CSF Gram stain, glucose and protein

What if antibiotic treatment has already been initiated?

Effect of Antibiotic Pretreatment on Cerebrospinal Fluid Profiles of Children With Bacterial Meningitis

Lise E. Nigrovic, MD, MPH[a], Richard Malley, MD[a], Charles G. Macias, MD, MPH[b], John T. Kanegaye, MD[c], Donna M. Moro-Sutherland, MD[d,e], Robert D. Schremmer, MD[f], Sandra H. Schwab, MD[g], Dewesh Agrawal, MD[h], Karim M. Mansour, MD[i], Jonathan E. Bennett, MD[j,k], Yiannis L. Katsogridakis, MD, MPH[l], Michael M. Mohseni, MD[m,n], Blake Bulloch, MD[o], Dale W. Steele, MD[p], Ron L. Kaplan, MD[q], Martin I. Herman, MD[r], Subhankar Bandyopadhyay, MD[s,t], Peter Dayan, MD, MSc[u], Uyen T. Truong, MD[v], Vince J. Wang, MD[w], Bema K. Bonsu, MD[x], Jennifer L. Chapman, MD[x], Nathan Kuppermann, MD, MPH[y], for the American Academy of Pediatrics, Pediatric Emergency Medicine Collaborative Research Committee

- 245 children with meningitis admitted to 20 paediatric emergency departments across the USA
- 85 (35%) pre-treated with antibiotics (up to 72 hours)
- Analyzed for association of antibiotic treatment with
  - CSF Glucose
  - CSF protein
  - CSF WBC count

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	n/N (%)		*P*
	No Antibiotic	Any Antibiotic	
Positive CSF Gram-stain results[a]	95/150 (63)	46/74 (62)	.86
Positive blood culture results[b]	123/187 (66)	16/33 (48)	.05
Positive CSF culture results[c]	136/154 (88)	53/76 (70)	.001

Appropriate antibiotics?

Third gen cephalosporins
Broad spectrum
Good CSF penetration
Superior activity in vitro against penicillin resistant pneumococci
Convenient administration
Expensive (?cheap generics available)
May promote extended spectrum beta lactamase resistance

To avoid overuse of Ceftriaxone an LP must be done to confirm ***diagnosis of meningitis***

CSF cell count and microscopy should be done immediately to guide treatment

What is ‘Severe Malaria’?

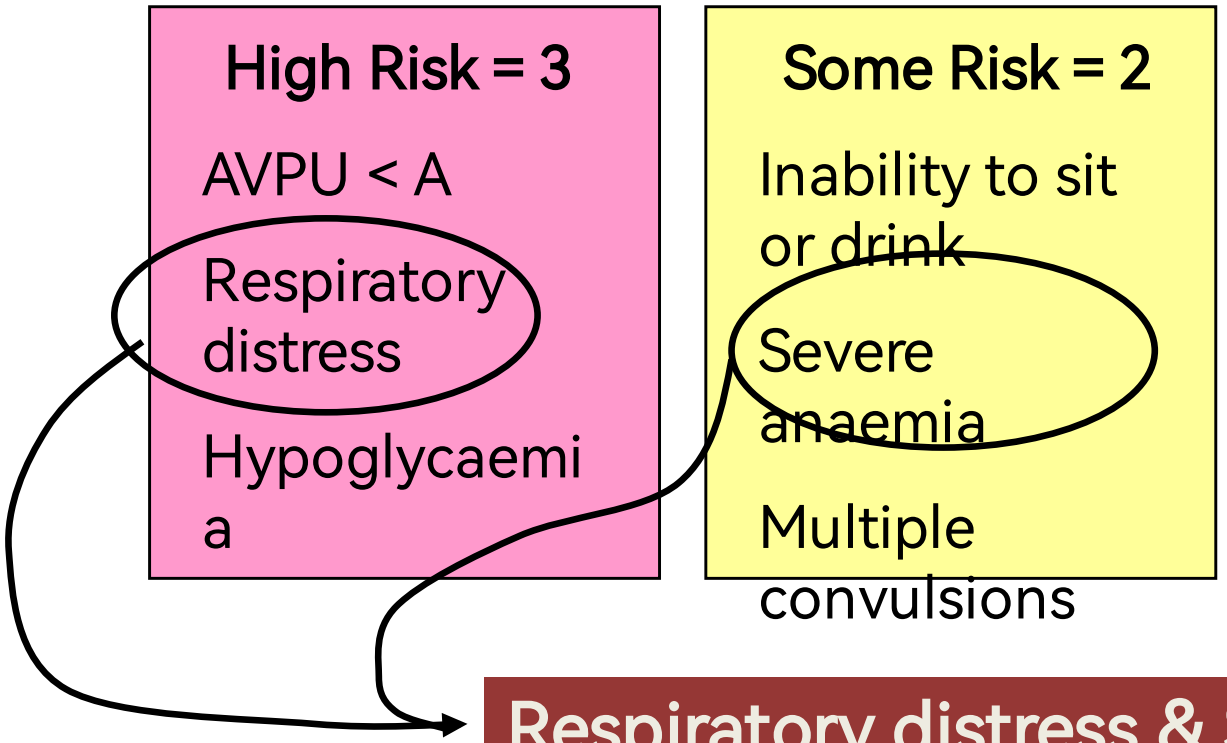
Severe Malaria in African children in endemic areas

- 'Cerebral malaria'
  - Strictly Coma = AVPU < P (AVPU = U)
  - In practice if AVPU < A or unable to drink
- Severe Malaria with Respiratory Distress
  - Deep, acidotic breathing & usually indrawing
  - Typically associated with anaemia / severe anaemia.
- Severe Anaemia
  - Hb < 5g/dl (<50g/L) or PCV / Haematocrit < 15%
  - As many as 40-50% of children with severe anaemia will NOT have respiratory distress
- **Plus positive diagnostic test (repeat up to 3 times if good quality slide test is negative)**

Life-threatening malaria

High risk of death	Some risk of death	Very low risk of death
AVPU < A	Inability to sit or drink	1 convulsion
Respiratory distress	Severe anaemia	High temperature
Hypoglycaemia	2 or more convulsions	Alert – can drink
Risk score = 3	**Risk score = 2**	**Risk score = 1**

Severe malaria



Respiratory distress & Severe Anaemia,

Risk scores 'multiply' so that child with more than one sign of severe malaria have very high risk of death (3 x 2 = 6!)

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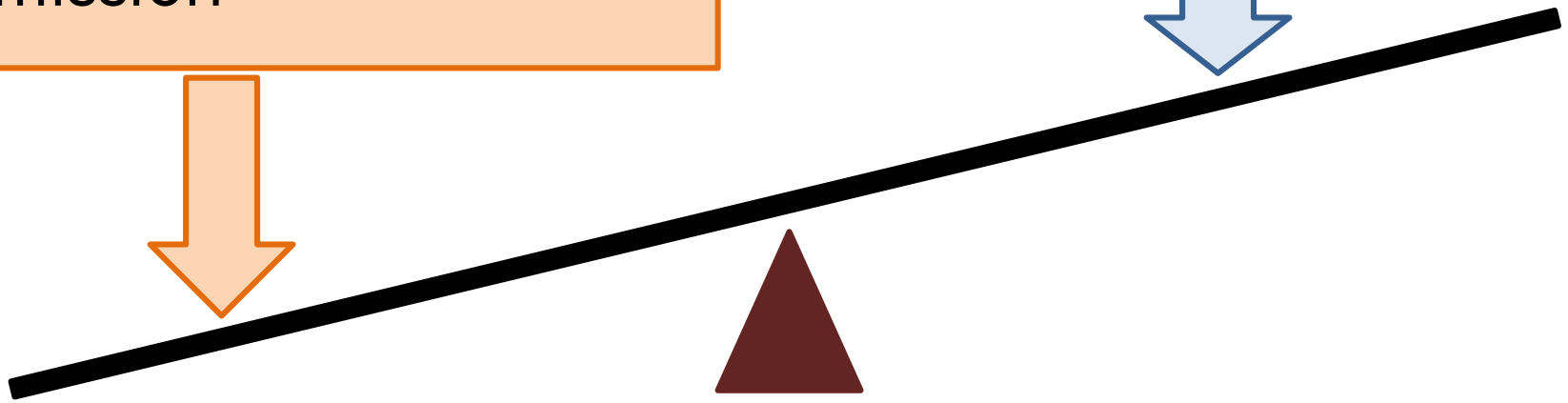
Best treatment for severe malaria?

Artesunate
Fewer deaths
Less incidence of hypoglycaemia, convulsion & coma after admission

Quinine
Higher risk of hyperinsulineamia & severe hypoglycemia



Artesunate benefits outweigh disadvantages

Artesunate now recommended 1st line in Kenya

Treating severe malaria using Artesunate

- Children weighing <20 kg should receive a higher parenteral dose of artesunate (3 mg/kg/dose) than that of larger children and adults (2.4 mg/kg/dose)
- Give 1st dose on admission; 2nd dose after 12 hours and 3rd dose at 24 hours
- Artesunate once daily doses can then be given for max 7 days but advisable to give for a minimum 24hrs then change to full course AL as soon as able to drink
- IV or IM routes of Artesunate can be used; and per rectal recommended for pre-referral treatment

Prevent hypoglycaemia by feeding / fluids

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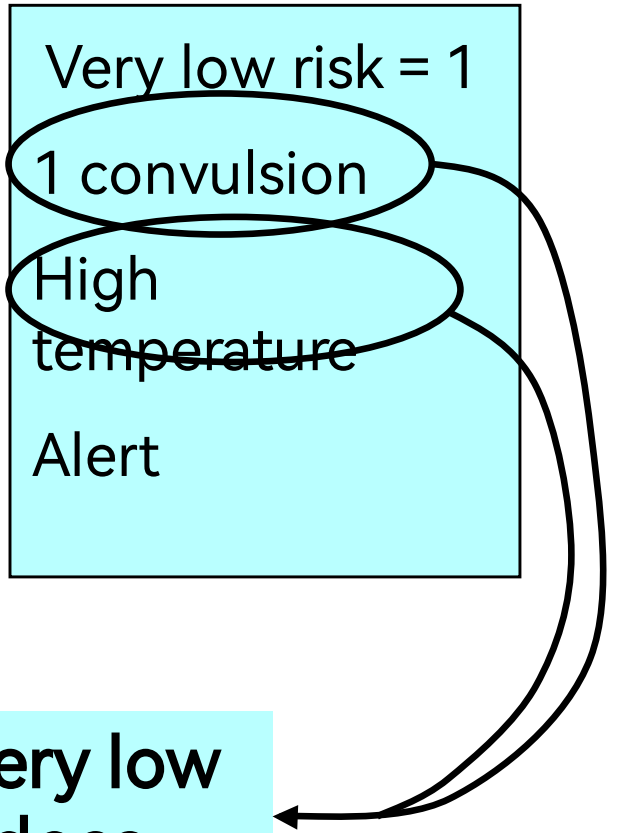
Non-severe malaria

These children need Oral treatment –

It works faster than Quinine and likely as well as Artesunate!



Even if there are two features of very low risk then overall the risk of death does not increase

(Risk score 1 x 1 = 1!)

Treating malaria – the child who can drink (in hospital too!)

- ✓Treatment that works fast to kill parasites and reduce fever
- ✓Treatment that is safe
- ✓Treatment that is highly effective
- ✓Treatment that saves nurses time

Oral
AL or other ACT

Mother / caretaker can monitor and report problems

Question?

Summary

- LP should be done in all cases of suspected meningitis for cell count and microscopy results to guide treatment
- Ceftriaxone is the treatment of choice in Kenya for proven meningitis
- Diagnostic test for malaria should be done in all suspected cases before starting treatment.
- Artesunate is the treatment of choice in severe malaria

Severe Acute Malnutrition 1 – Recognition And Early Treatment

- Mortality is often above 30%

Objectives

1. Learn to recognise severe acute malnutrition
2. Learn to manage ALL the problems present in these children
3. Understand new approaches to feeding and recognise it as the primary treatment.

Definitions of Acute Malnutrition

	MUAC cm (6–59 months)	WHZ
None	>13.5	>-1
At Risk	12.5 to 13.4	-2 to -1
Moderate	11.5 to 12.4	-3 to -2
Severe	**<11.5**	**<-3**
	Kwashiorkor(oedema of both feet)	

Advantages of MUAC over WHZ score

- More acceptable to children compared to height or weight
- Can be done by one person
- No reference table required, single cut off applied independent of age, sex, height
- Colour-coded tapes
- Not affected by condition that affect weight e. g oedema, dehydration

Weight Height Reference Tables

Weight-for-length GIRLS
Birth to 2 years (z-scores)

World Health Organization

cm	-3 SD	-2 SD	-1 SD	Median	+1 SD	+2 SD	+3 SD
60.0	4.5	4.9	5.4	5.9	6.4	7.1	7.8
60.5	4.6	5.0	5.5	6.0	6.6	7.3	8.0
61.0	4.7	5.1	5.6	6.1	6.7	7.4	8.2
61.5	4.8	5.2	5.7	6.3	6.9	7.6	8.4
62.0	4.9	5.3	5.8	6.4	7.0	7.7	8.5
62.5	5.0	5.4	5.9	6.5	7.1	7.8	8.7
63.0	5.1	5.5	6.0	6.6	7.3	8.0	8.8
63.5	5.2	5.6	6.2	6.7	7.4	8.1	9.0
64.0	5.3	5.7	6.3	6.9	7.5	8.3	9.1
64.5	5.4	5.8	6.4	7.0	7.6	8.4	9.3
65.0	5.5	5.9	6.5	7.1	7.8	8.6	9.5
65.5	5.5	6.0	6.6	7.2	7.9	8.7	9.6
66.0	5.6	6.1	6.7	7.3	8.0	8.8	9.8
66.5	5.7	6.2	6.8	7.4	8.1	9.0	9.9
67.0	5.8	6.3	6.9	7.5	8.3	9.1	10.0
67.5	5.9	6.4	7.0	7.6	8.4	9.2	10.2

Definitions of Severe Acute Malnutrition

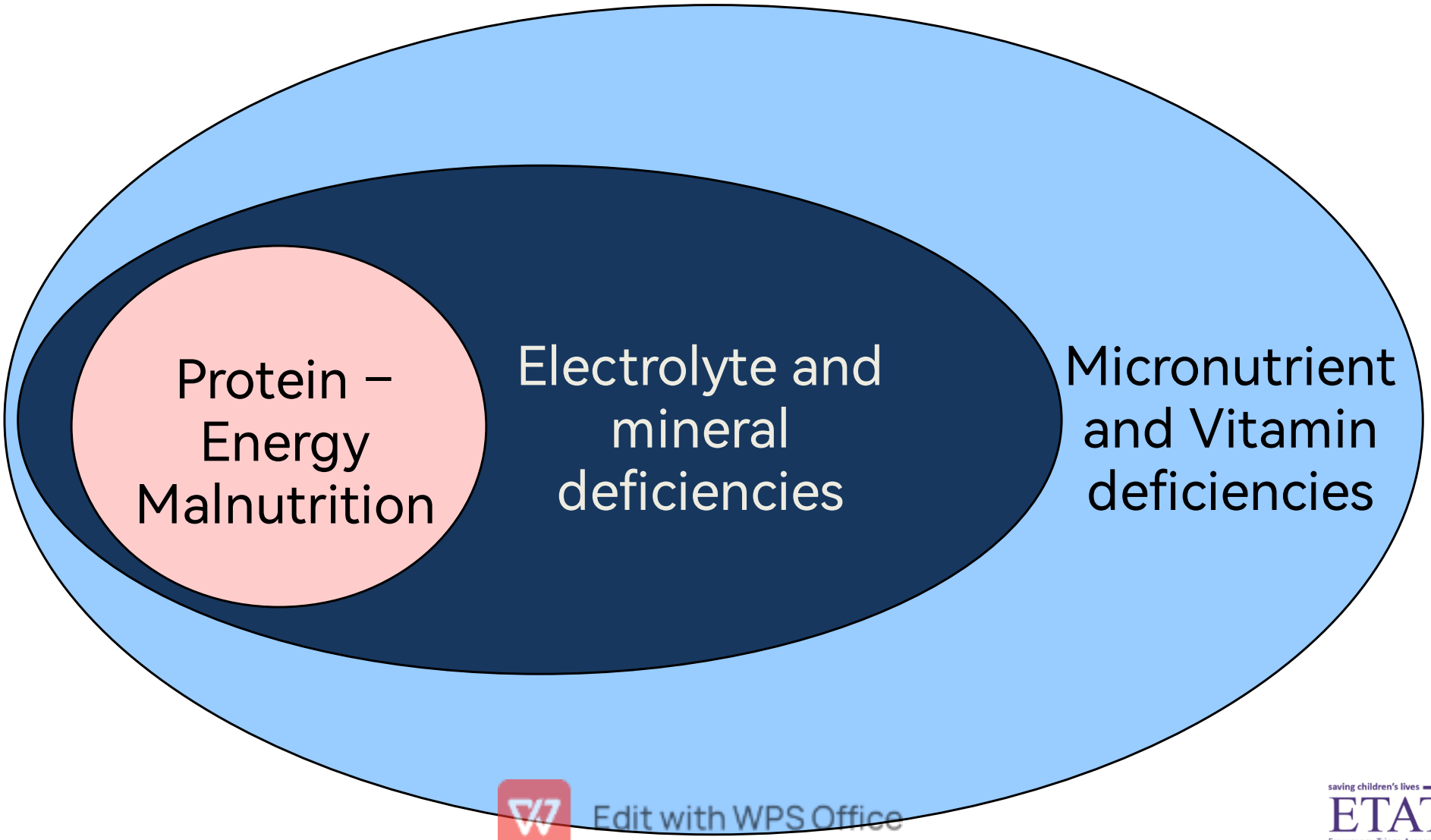
Aged <6 months	Aged 6-59months
WHZ score ≤3SD or edema of both feet	MUAC <11.5 cm or edema of both feet

Indications for hospital admission

- Medical complications
  - Inadequate breathing
  - Severe or some circulatory compromise
  - Altered consciousness
  - inability to feed
  - Convulsions
- Loss of appetite/unwilling to feed

What problems other than protein and energy deficiency do children with SAM have?

Severe malnutrition



Reductive adaptation in severe acute malnutrition (SAM)

- Body systems slow down in order to survive with limited calories (reductive adaptation)
- SAM causes physiology and metabolic changes in every cell, organ and system requiring the child to be treated differently
- During treatment the systems must be awakened slowly to 'learn' to function again

Reductive adaptation

In severe acute malnutrition energy is conserved by reducing:

- Physical activity and growth
- Basal metabolism by slowing protein turnover
- Functional reserve of organs,
- Number of sodium and potassium pumps in cell membranes and slowing them
- Reducing inflammatory and immune responses

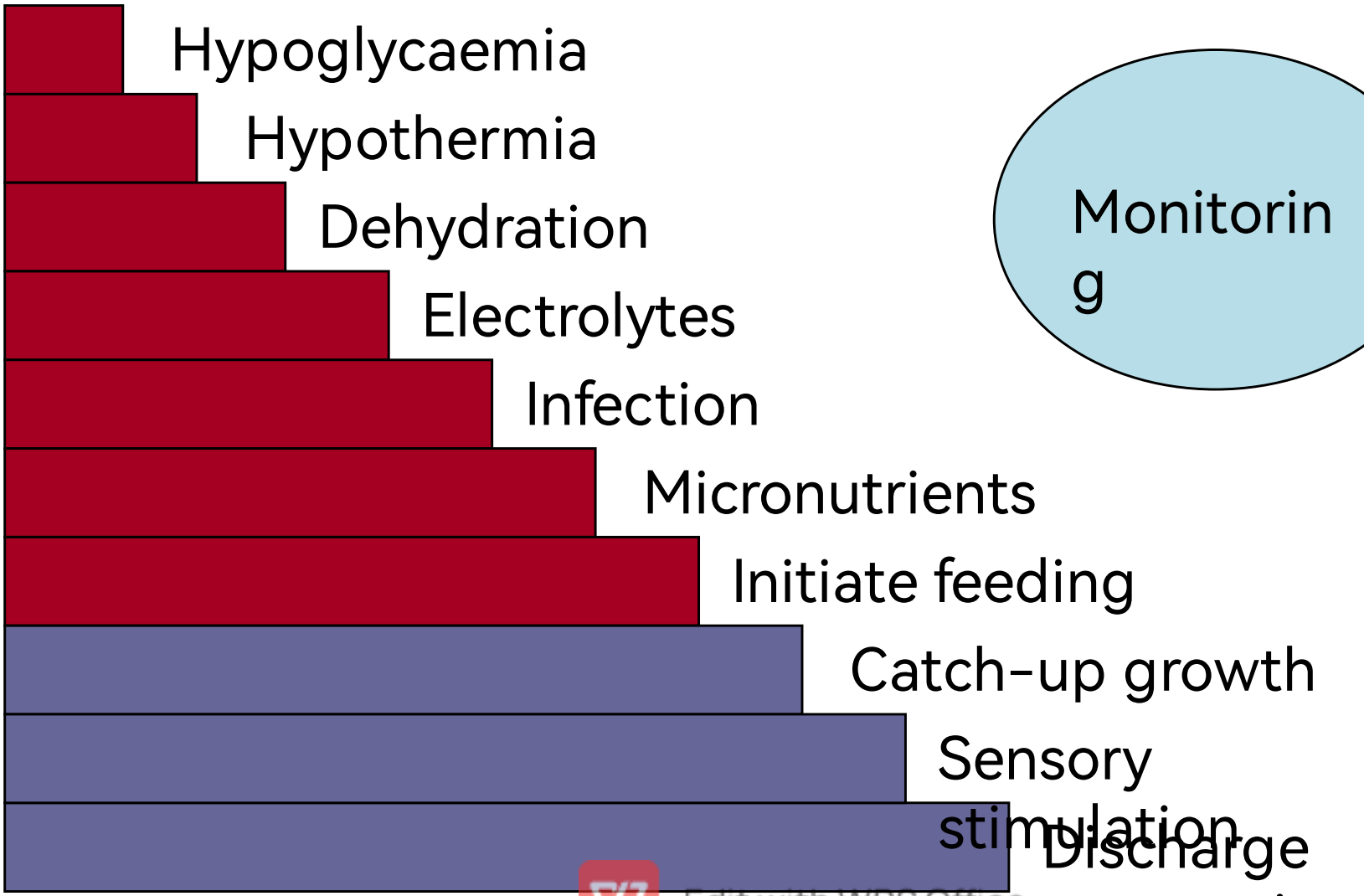
	Effect of reductive adaptation	Action in mnx
Infections.	Body has limited energy to mount local and systemic inflammatory responses eg fever, inflammation	Presume and treat infection in all
Iron	Make less Hb than usual. Unused iron stored. Giving iron early leads to 'free iron'- formation of free radicals & promotes bacterial growth	No supplemental iron during the initial period of treatment.
Sodium & potassium	Na/K pump slows down in SAM. Sodium level in cells rises while potassium leaks out and lost in the urine. Results in high total body sodium & low potassium	Diarrhea – use fluid with ↓ Na & ↕ K
		Give foods with Low Na & supplement K

Reduction in function capacity of organs

	Effect of reductive adaptation	Action at the beginning of the treatment
Liver	Less able to make glucose Less able to excrete dietary proteins and toxin	Avoid IVF Calories (100Kcal/kg/day) and proteins (1gm/kg/day) just to meet basic need, sufficient to halt catabolic process and to avoid stress to vital organs and system Increase calorie & protein intake once metabolic machinery & physiology improves.
Kidney	Less able to excrete excess fluid and sodium	
Heart	Smaller and weaker and has reduced output	
Gut	Less acid, small amount of enzymes, villi flattened and motility reduce	

Reduction in functions of major organs – little margin for error.

10 Step Approach



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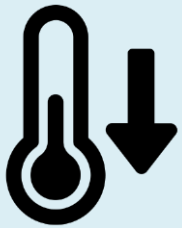
Hypoglycaemia and Hypothermia



- All new admissions with malnutrition should be kept warm until there are signs of recovery.
- Immediate NGT feeding for conscious children with blood glucose < 3mmol/l
- IV or NGT glucose for those who are unconscious or very severely ill with no glucose measurement.

Dehydration

- Shock is treated by using Ringer's / Hartmann's solution with 5% dextrose over two hours.
- Oral rehydration is achieved by using Rehydration solution for Malnutrition (RESOMAL.)
- Feeding must be introduced during the first 12 hours of treating dehydration, ideally within 4 hrs.

Oral re-hydration in Severe Malnutrition

- Resomal 5ml/kg every 30 mins for 2 hours
  - Simplified to 10mls/kg every hour.
- Use an ngt early.
- Then 5 – 10 mls/kg each hour for a maximum of 10 hours
  - Give 10mls/kg if the child thirsty / severe dehydration, 5mls/kg if not.
- Introduce starter milk (F-75) at 4 hours and slowly replace Resomal with starter milk over 12 hours.
- Continue breast feeding throughout.

Prescription of ReSoMal of 5kg child

Time	ReSoMal	F75
On admission (9am)		
10am		
11am		
12MD		
1pm		
2pm		
3pm		
4pm		
5pm		
6pm		
7pm		
8pm		
The at 11pm F75 80mls every 3hrly. Give 50mls ReSoMal for every loose stool		

Supplemental Zinc not required – ReSOMal & F75/100 contains Zinc

Electrolyte / Mineral Deficiencies

- Potassium:
  - Potassium supplements help reduce oedema
- Magnesium
- Zinc
- Copper
- Selenium

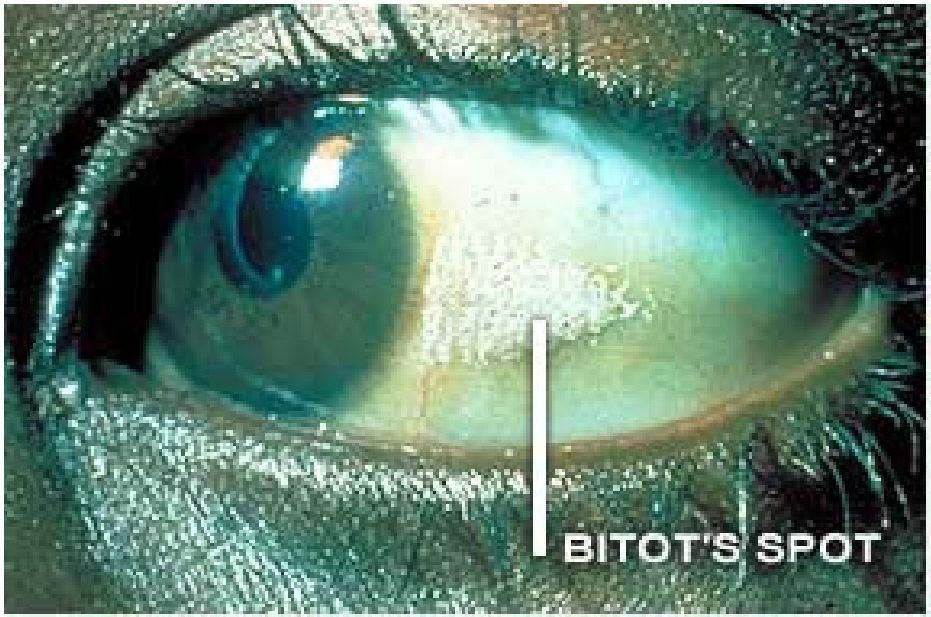
- **There is too much sodium so salty foods can be dangerous**

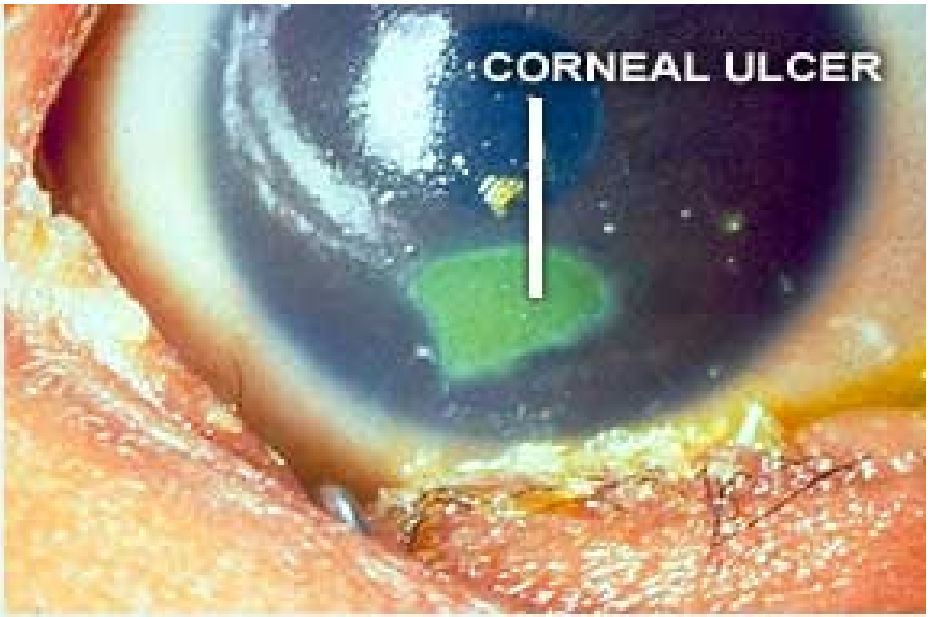
Pre-packaged F75 and F100 and Ready to Use Foods (RUTF) have all the 'good vitamins and minerals' – they do not need to be added

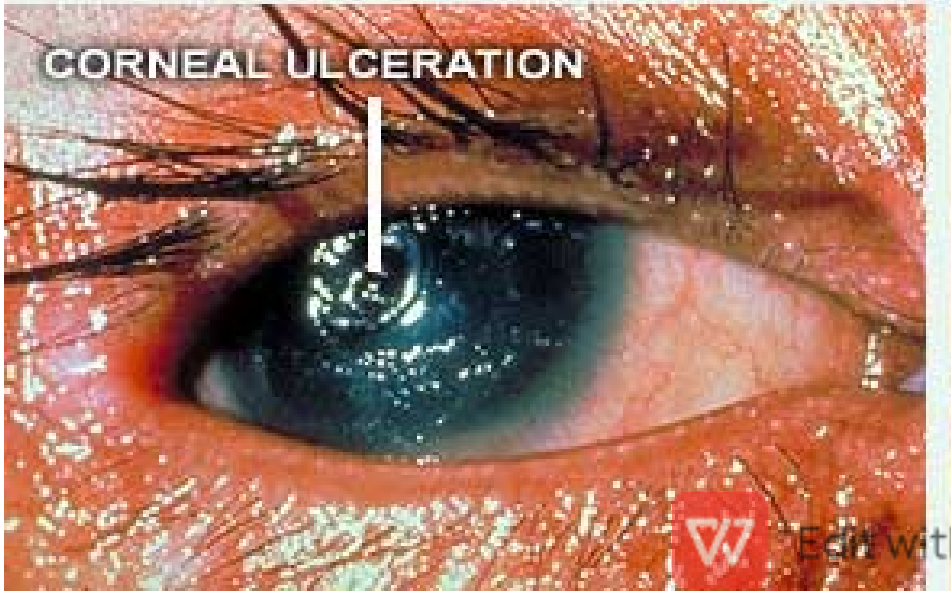
Infection

- Up to 1/3rd children with malnutrition who die ha septicaemia / bacteraemia
- Fever and other signs of infection are not helpful in identifying infection in these children
- ALL sick children with severe malnutrition in hospital should be started on :
  - IV/IM Penicillin for 2 days then oral amoxicillin for 5 days
  - Gentamicin for at least 5 days.
- In addition they receive:
  - Treatment for thrush if present
  - TEO if there are red eyes.
  - Select antibiotics according to suspected infection eg osteomyelitis

Vitamin A deficiency







Vitamins

- High dose Vitamin A:
  - **With Eye signs:** 200,000 IU (100,000 IU if aged < 12 months)
    - **on admission**
    - **on Day 2**
    - **Day 14**
  - **Without Eye signs**: high dose vitamin not indicated

Questions?

Summary.

- The risk of death in children with severe malnutrition is very high.
- Bodies of children with SAM undergo reductive adaptation that affect every cell, organ and system
- The children have many problems and each needs treating.
- The 10 steps approach allows each problem to be treated

Severe Acute Malnutrition 2 – Nutritional Treatment.

HARAMBEE

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Objectives

1. Understand the link between observed pathophysiological abnormalities and treatment.
2. Consider the priorities and aims of immediate nutritional management.
3. Non-nutritional management is considered elsewhere.

Gentle nutritional rescue – the process of feeding

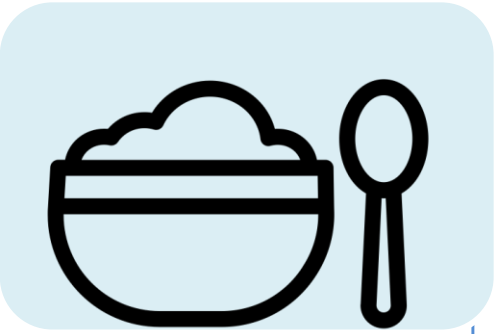
- Immediate feeding
- Small volume / frequent feeding because of small stomach capacity and precarious physiology
- Vomiting is NOT a contraindication to feeding
- Routine insertion of a naso-gastric tube should be considered
- Feeds are the 'drug' to cure malnutrition, they are a priority (after correction of dehydration if required).

First feeding – Prescribing F75

- What is the weight?
- Severe acute malnutrition with no or moderate oedema
  - 130 ml/kg/day start-up feed
- Severe acute malnutrition with severe oedema (of the face):
  - 100 mls/kg/day start-up feed
- 8 three hourly feeds
- ***…..this means at night too!***

F75 can be made from water, skimmed milk, oil and sugar – it is cheap, recipes are in the WHO Pocketbook!

Why don't we feed aggressively in the "rescue phase"?



- The body really cannot tolerate more
- Too vigorous re-feeding has been associated with increased mortality.
- Too much sugar can cause an osmotic diarrhoea
- Higher protein contents cannot be handled by the liver
- Salt can make oedema worse and precipitate heart failure

When to change from F75 ?

- Appetite test
  - If the child is clearly very hungry then use RUTF immediately – ***does this child need to be in hospital?***
- Return of appetite after starting on F75:
  - Usually between 2 – 7 days
  - Transition to F100 or RUTF if available
- Oedema:
  - You <u>do not</u> have to wait for resolution of oedema before changing if the child has a good appetite.
- Feed with cup / cup and spoon

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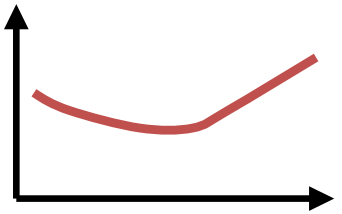
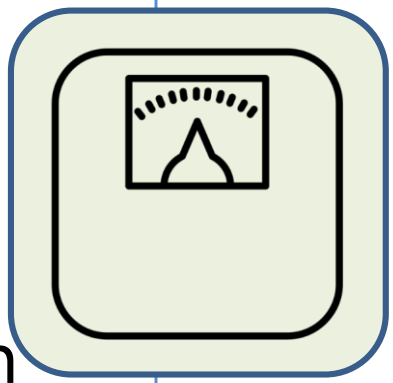
Weight gain in the first week



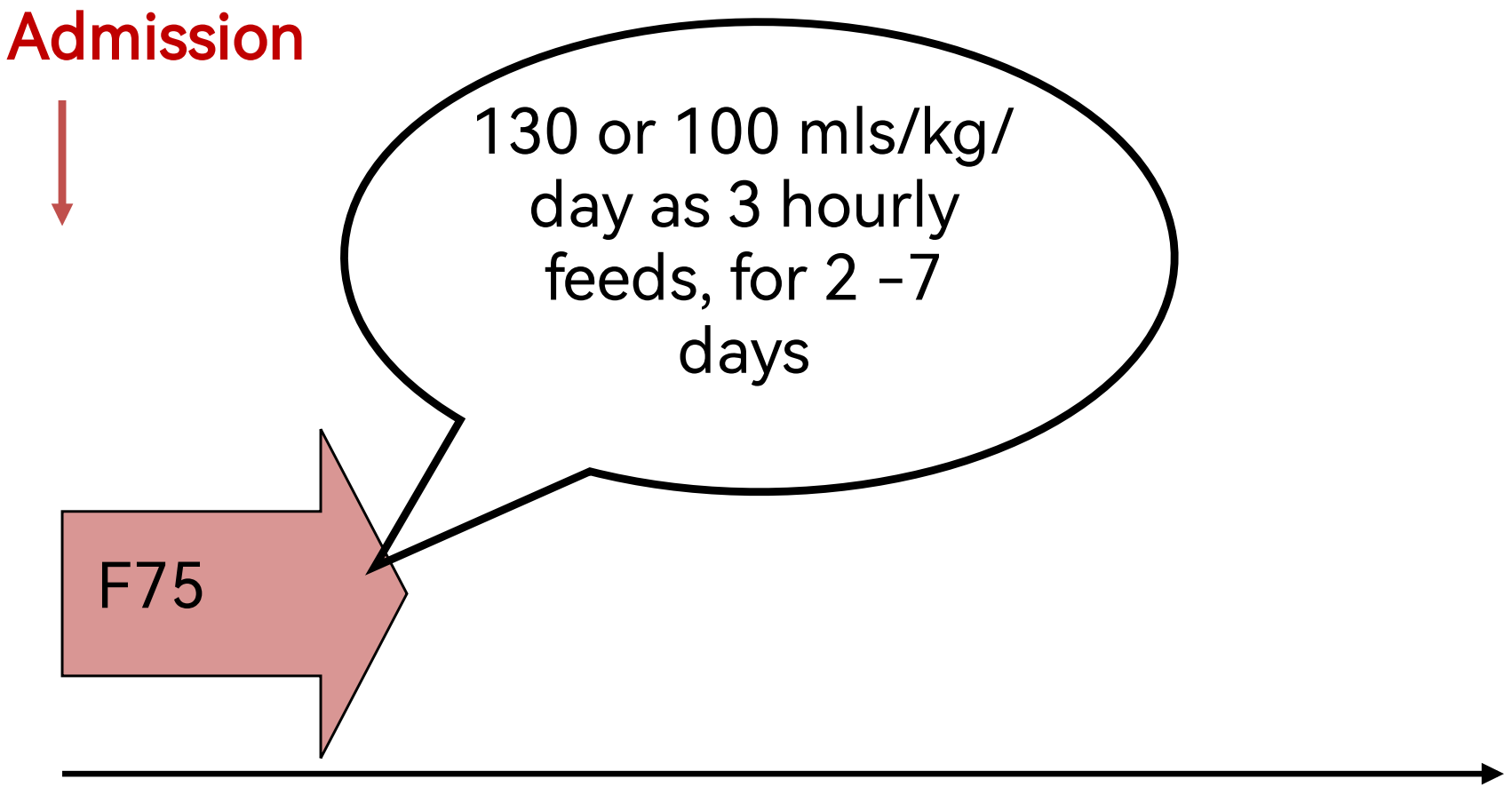
- F75 feeding is usually NOT associated with weight gain
- Weight loss may even occur in children whose oedema is improving
- Do not panic!
  - Ensure at least 100 mls/kg/day of F75 has been given.
  - Early recovery involves loss of body water (reducing weight) and increases in cellular mass (increasing weight)
- Appetite and activity level denote recovery in the first week, not weight change.



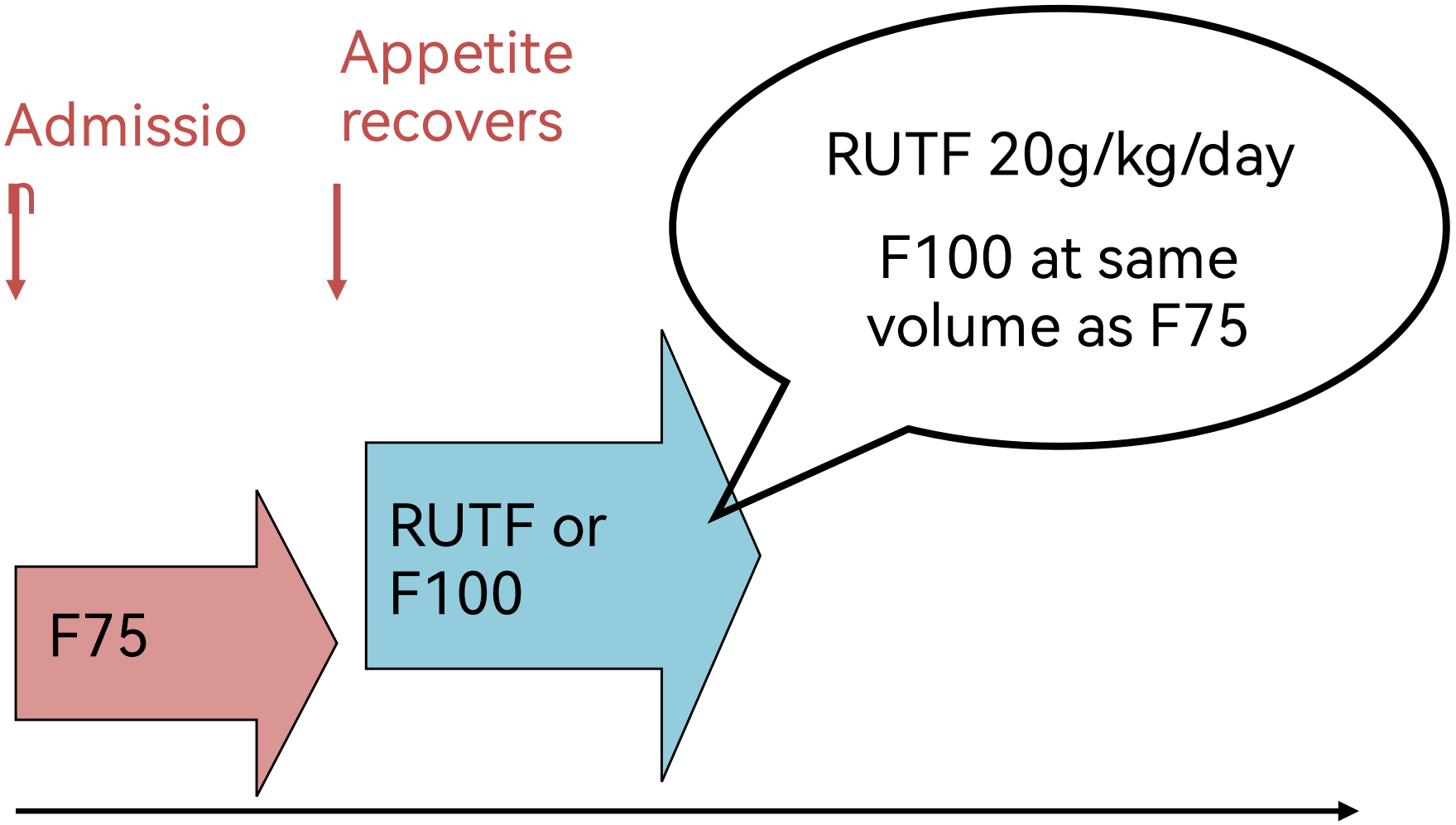
Contents of 100mls of F75 & F100

	F75	F 100
Energy (kcal)	75	100
Protein (g)	1.1	2.9
Lactose (g)	1.3	4.2
Potassium	4.2	6.3
Sodium	0.6	1.9

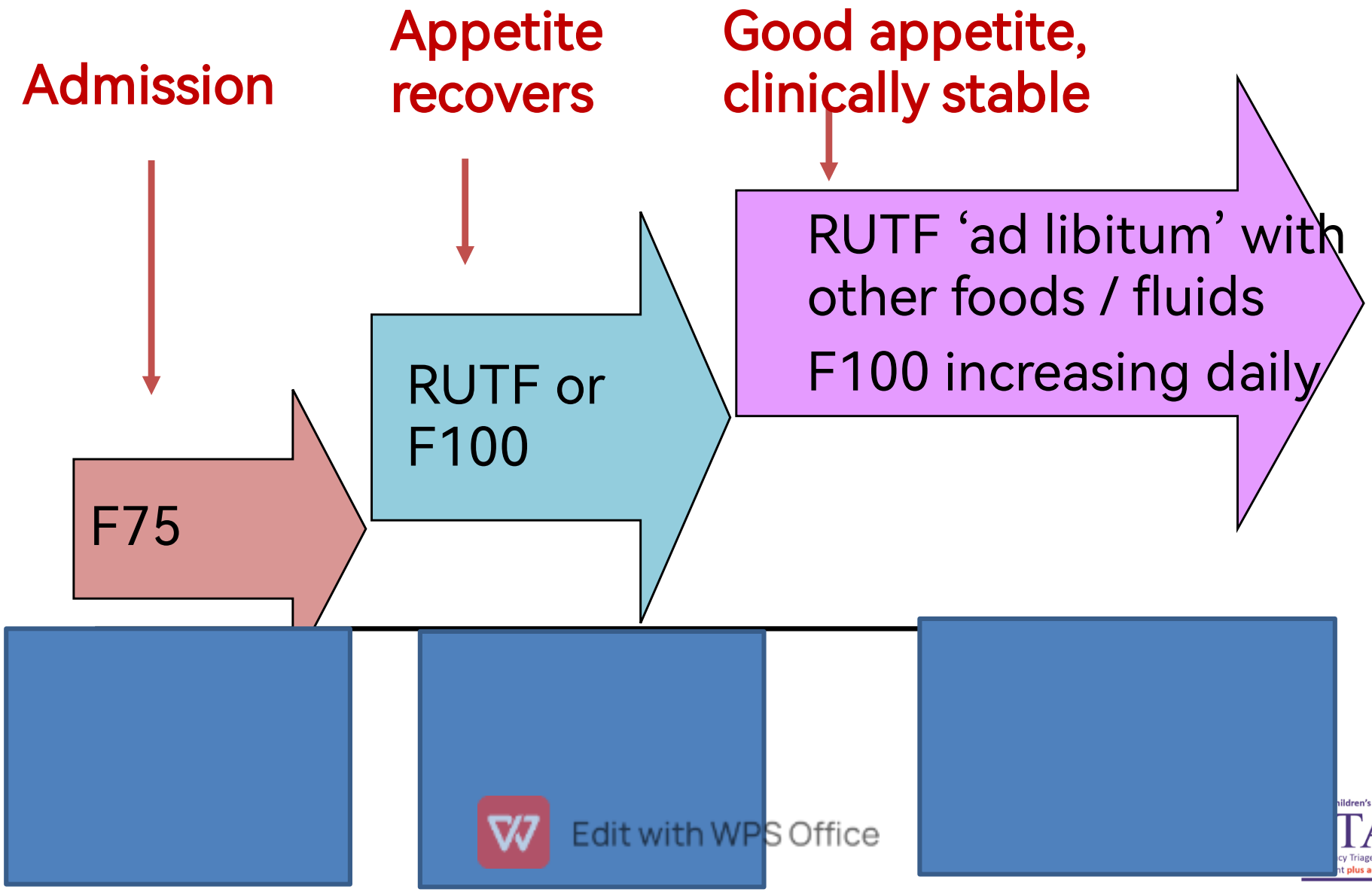
A feeding plan if seriously ill



A feeding plan



A feeding plan



Then what?

Rehabilitation

- Introduce solid foods and increase to 5 appropriate meals a day.
- Continue RUTF / snacks in between
- Continue breast feeding
- Start oral iron and mebendazole therapy **after 1 week (Note! RUTF already contains adequate iron)**
- Monitor progress
- Provide stimulation / play
- Educate the family and prepare for discharge

Monitoring 1

Rescue	Transition	Rehabilitation
Fever / Hypothermia	Fever / Hypothermia	WHZ (<6mo)
Glucose	Respiration	MUAC (6-59mo)
Respiration	Heart Rate	Weight
Heart Rate	Weight	
Weight	Oedema	
Oedema		

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Monitoring 2

- Feed **intake must be monitored** throughout.
  - **Check feeding charts daily!**
- If there is concern for heart failure reduce feed amount / volumes for 24 hours.
- Weight gain in recovery/rehabilitation phases:
  - Poor, <5g/kg/day, full re-assessment
  - Moderate, 5 – 10g/kg/day, check intake adequate, is there untreated infection

Monitoring 3

Example for weight gain over 3 days.

Current weight of the child in grams = 6300 g
Weight 3 days ago in grams = 6000 g

- **Step 1.** Calculate wt gain in grams: 6300−6000
  = 300 g
- **Step 2.** Calculate average daily wt gain: 300g÷3days =100g/day
- **Step 3:** Calculate child's average wt in Kg: (6.0+6.3) ÷ 2
  = 6.15kg
- **Step 3.** Divide by child's average wt in kg: 100g/day÷6.15kg **= 16.3 g/kg per day**

Refeeding syndrome

Definition: Electrolyte depletion, fluid retention & altered glucose homeostasis that occurs in malnourished patients on commencing oral, enteral or parenteral nutrition

When feeding is initiated, serum glucose levels ↑ ↑, triggering insulin secretion in the presence of body deficit of K^+, Pho & Mg^{2+}

mechanism

↑ ↑ insulin levels drives Pho & K+ intracellularly 2^0 stimulation of the Na^+/K^+ ATPase pump & ↑ ↑ demand (phosphorylation of glucose with initiation of glycolysis)

N/B! ↓ ↓ in serum electrolytes may be sudden & severe & can be deadly for an individual in a starved state

Effect of deranged electrolytes in refeeding syndrome

Hypophosphatemia

Phosphate is a vital component of ATP. Deficiency leads to:

- Respiratory muscle dysfunction, progressing to acute respiratory failure
- ↓ ↓ cardiac contractility.
- Cardiac arrhythmias (phosphorus is important in electrical impulses conduction).
- ↓ ↓ production of 2,3 -DPG, causing an ↑ ↑ in Hb O_2 affinity, ↓ ↓ O_2 release to tissues & tissue hypoxia

Hypokalemia

- Impaired transmission of electrical impulses & ↑ ↑ risk of lethal cardiac arrhythmias.
- Weakness, hyporeflexia.
- Respiratory depression.
- Paralysis

Hypomagnesiunemia

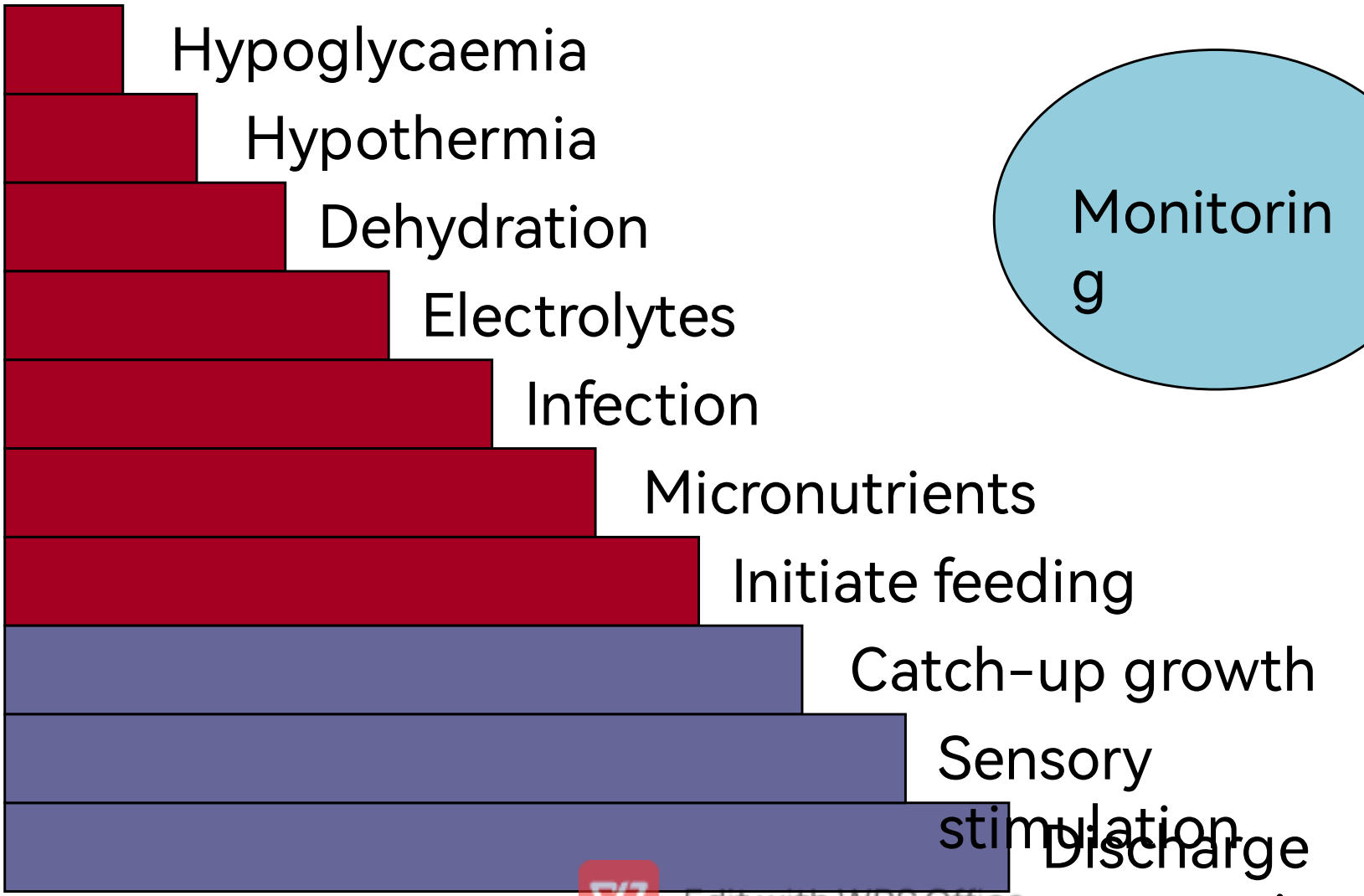
- Impairs K+ reuptake in the nephron, resulting in excess losses.
- Impairs cellular transport of K+ through impact on Mg^{2+} dependent enzymes e.g. Na-KATPase

Da Silva JSV, Seres DS, Sabino K, et al. ASPEN consensus recommendations for refeeding syndrome. Nutr Clin Pract. 2020; 35(2): 178- 195.

When to discharge

- Completed antibiotics
- Medical complications have resolved
- Good appetite and gaining weight
- Oedema has reduced
- Appropriate support in the community or home
  - Should discharge on RUTF
- Mother / carer:
  - Available
  - Understands child's needs
  - Able to supply needs

10 Step Approach



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Questions?

Summary

- The rescue phase of nutritional support requires gentle introduction of calories and small amounts of protein.
- Pre-manufactured F75, F100 and RUTF are used because they contain adequate potassium, vitamins and ideally other minerals.
- Recovery feeding starts as the appetite returns and is gradually scaled up.

Neonatal Resuscitation

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Kenya Paediatric Research Consortium

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Objectives

- To outline the optimum approach to newborn resuscitation.
- To present global best practice guidelines.

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.

The Golden Minute

Newly born – Infant at the time of birth

- Crying or breathing?
- Good muscle tone

Yes to ALL

At every delivery, there should be at least 1 person whose primary responsibility is the newly born.

Dry baby and place in skin-to-skin with the mother, cover with dry linen to maintain temperature.

APGAR Score & Essential Newborn Care

The Golden Minute

- Crying or breathing?
- Good muscle tone

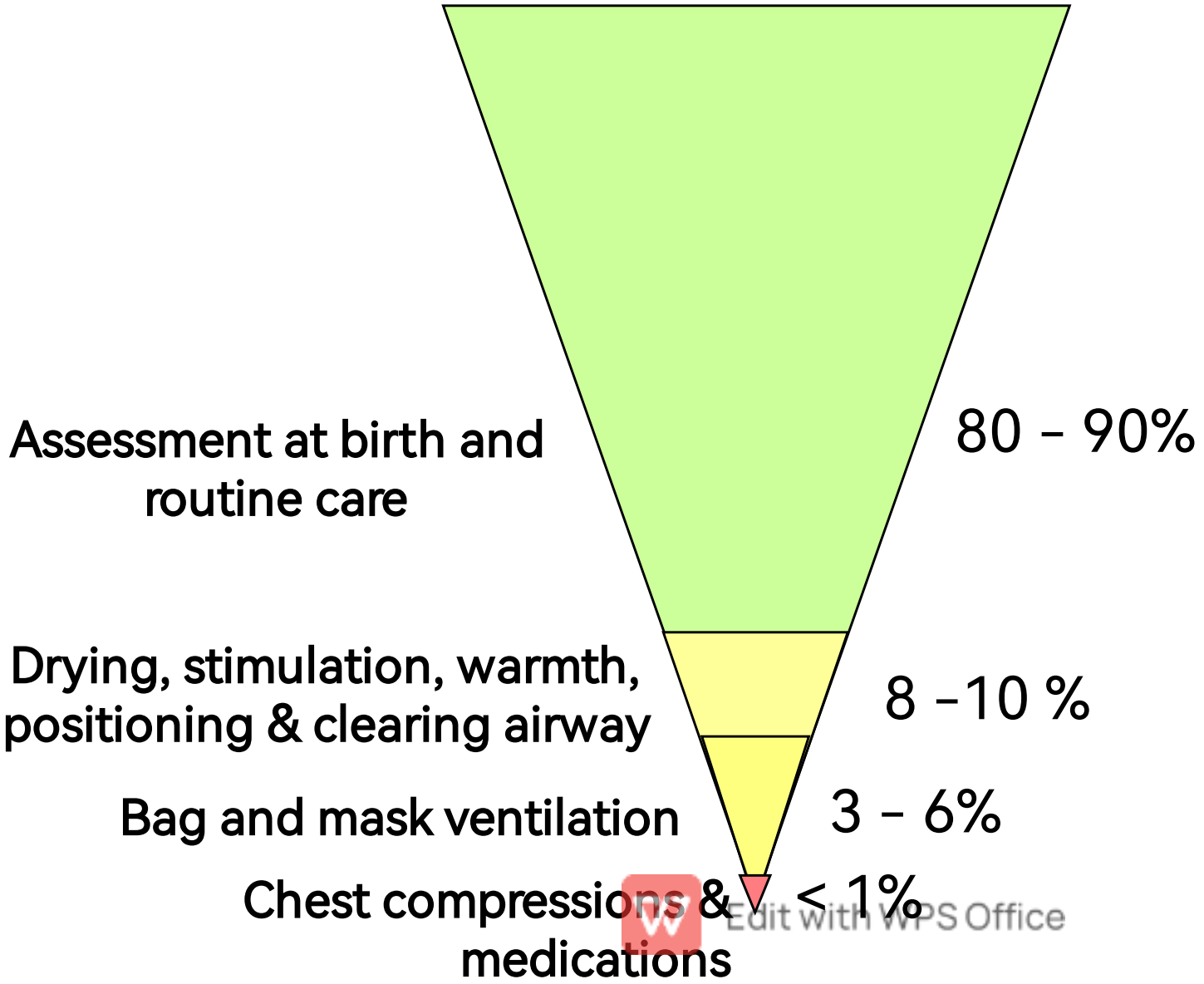
NO to any

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



- 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)

Anticipation of Resuscitation

Anticipation for resuscitation

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

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

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, Emergency C/S

Antepartum complications

- Placental anomalies (e.g. placenta previa or placental abruption)

Good ANC and labor management is key!!!

Checklist for resuscitation

Warmth

- Prewarmed radiant warmer with a temperature probe
- Warm and sterile towels or blankets
- 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 & Pulse ox

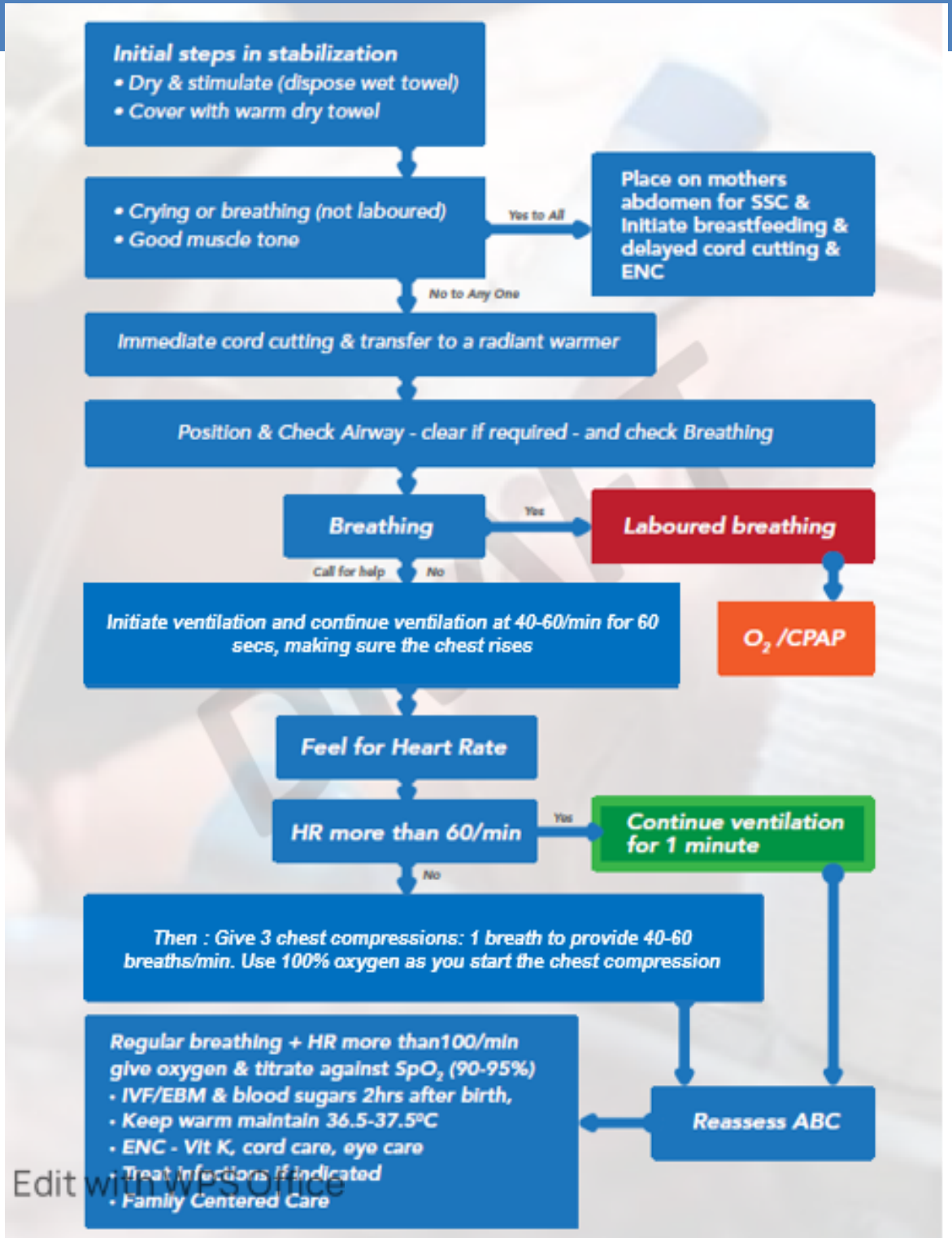
Circulation
C

- Stethoscope

Drugs
D

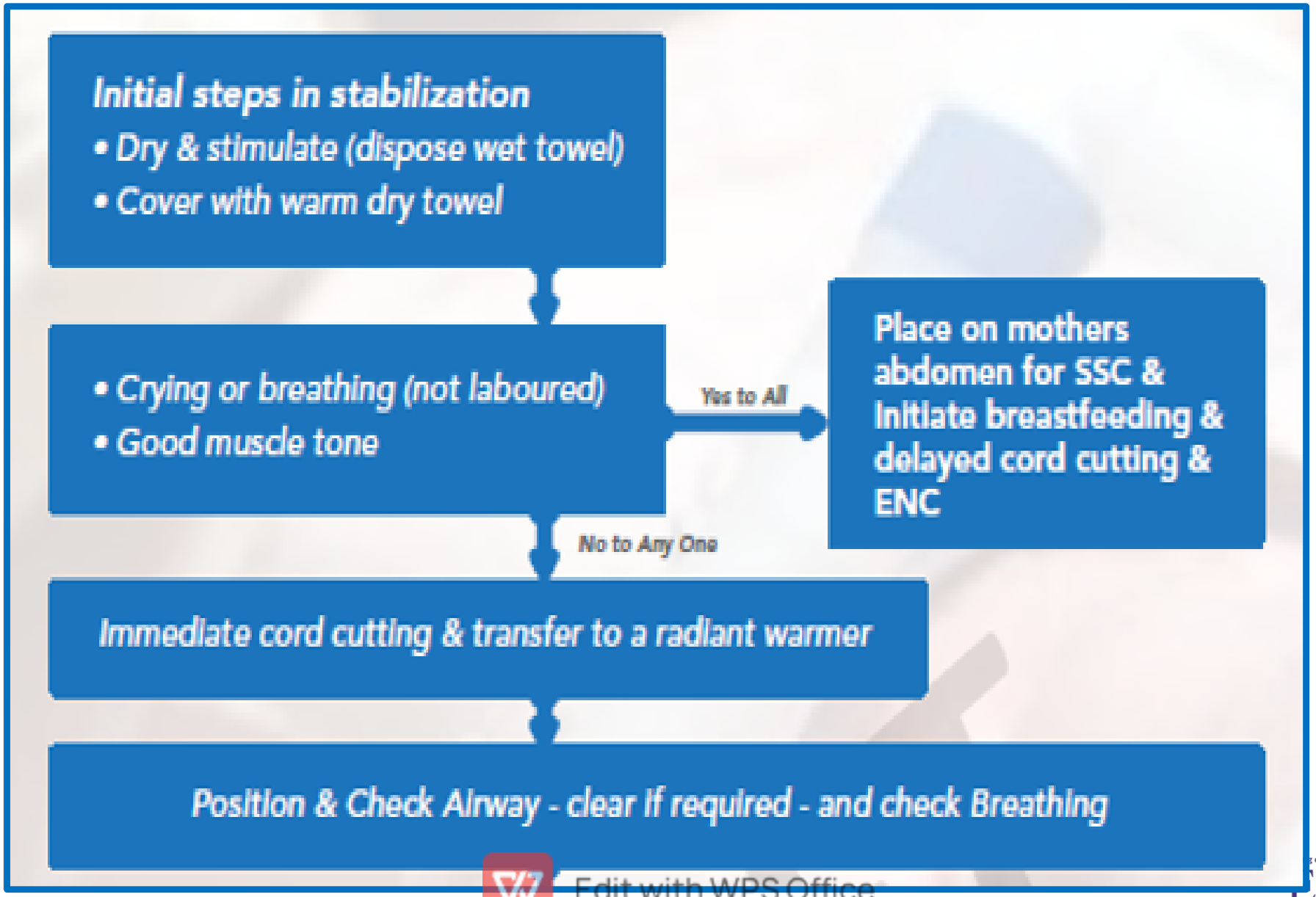
- IV epinephrine at 0.01 to 0.03 mg/kg of 1:10 000
- RL or 0.9% NaCl
- Blood transfusion

Outline



Initial Stabilization

Initial steps in stabilization



Temperature control

- The goal is to achieve normothermia (36.5–37.5°C) and avoid iatrogenic hyperthermia.
- Hyperthermia and hypothermia associated with worse neurological outcomes.
- Temp. monitoring is crucial

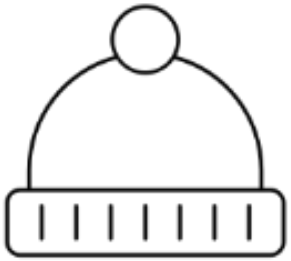
Special groups

- Very low-birth-weight (<1500gm, less than 32 weeks) babies are more likely to become hypothermic
- Asphyxiated newborns

Techniques of Temperature regulation

Keeping warm

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



Techniques of Temperature regulation

For babies who don't require resuscitation

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

Techniques of Temperature regulation

Special circumstances

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

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

Umbilical cord management

Current recommendations

Immediate cord cutting

For newborns who require resuscitation

Delayed cord (1 – 3mins) clamping

For newborns with a good heart rate and spontaneous breathing

Umbilical cord management

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 is not appropriate

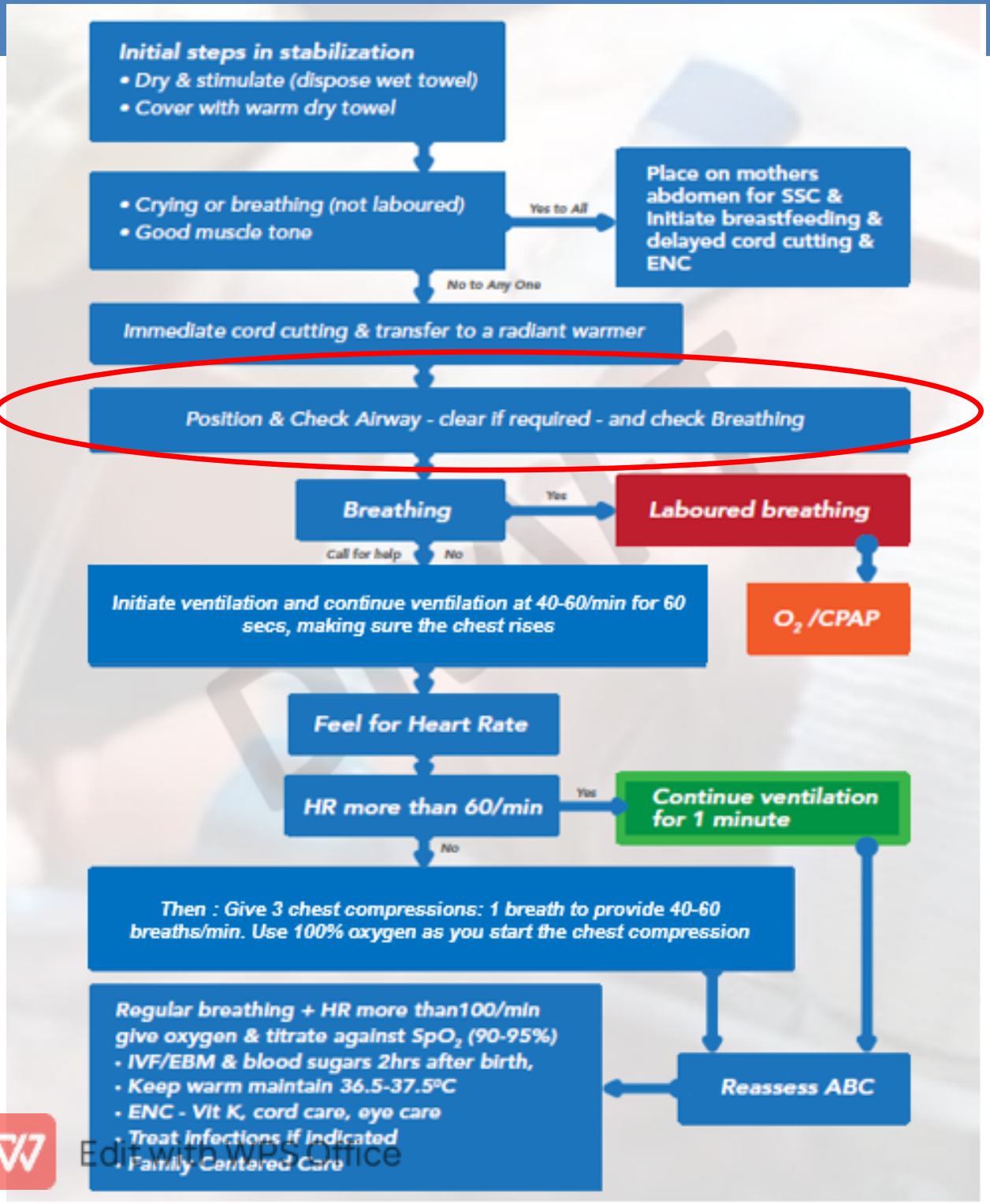
Current recommendation

Umbilical cord milking is NOT recommended – 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



Airway Positioning

Figure 3.5. CORRECT: "sniffing" position

Sniffing position –

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

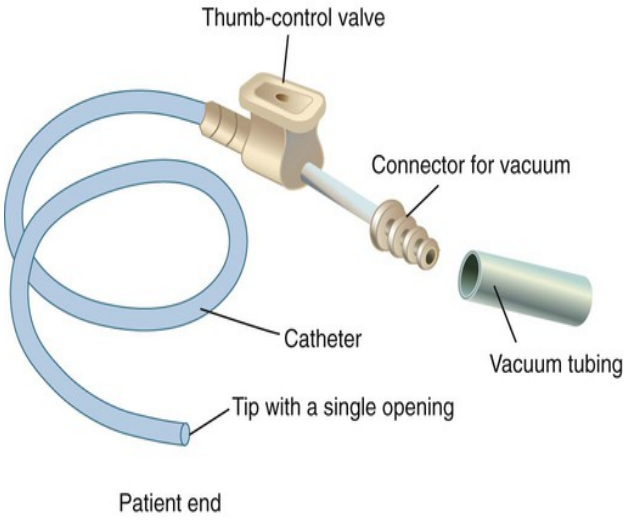
Current Recommendation

- Neonates should be placed in the 'sniffing position' to maintain airway patency.
- May use a towel to support 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

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.



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

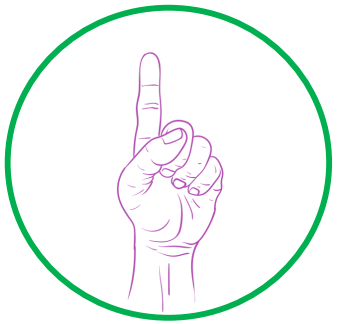
Current evidence regarding suctioning meconium

No difference in incidence of:

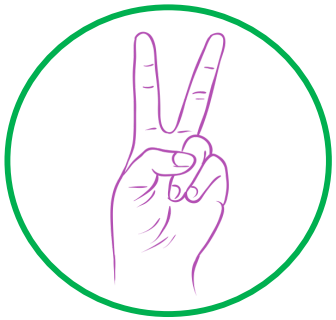
- Meconium aspiration syndrome (MAS)
- Need for oxygen/respiratory support
- Development of complications
- Mortality

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

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**

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

Check airway positioning,
Ventilation technique,
alternative methods

Oropharyngeal suctioning

Oropharyngeal Suctioning

Penguin Sucker

Bulb Sucker

Suction Machine

Wide bore sucker (yankheur)

Suction catheters

Manual Suction using a bulb or penguin sucker

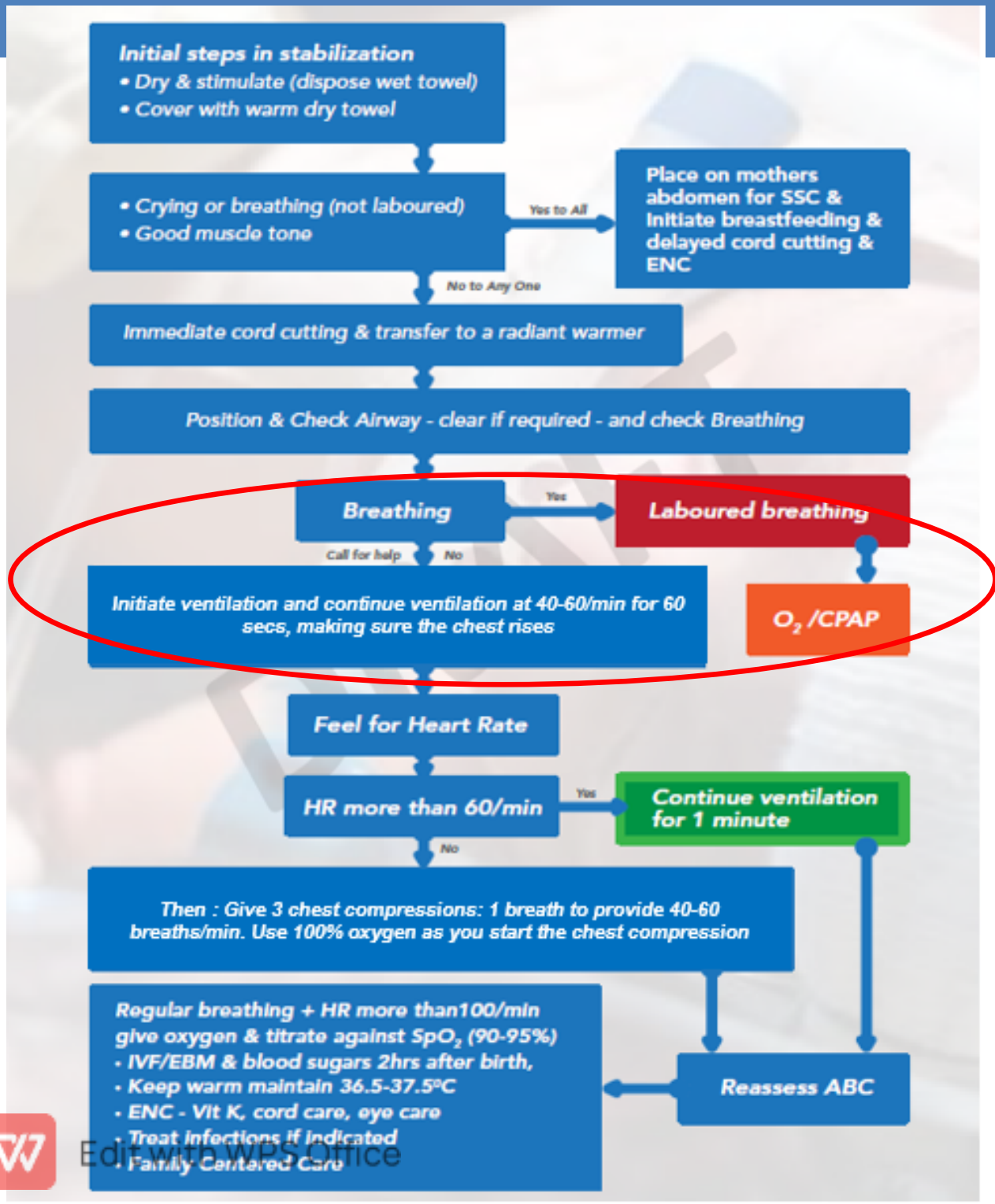
Suction using a suction machine attached to a wide bore sucker (yankeur) or a suction catheter

Wear Appropriate PPE

Image source: NEST Clinical Modules – www.NEST360°.org

Breathing

Breathing



Breathing Assessment

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

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.

Ventilation equipment for the first one minute

Bag, Valve and Mask (BVM) 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

Parts of the BVM

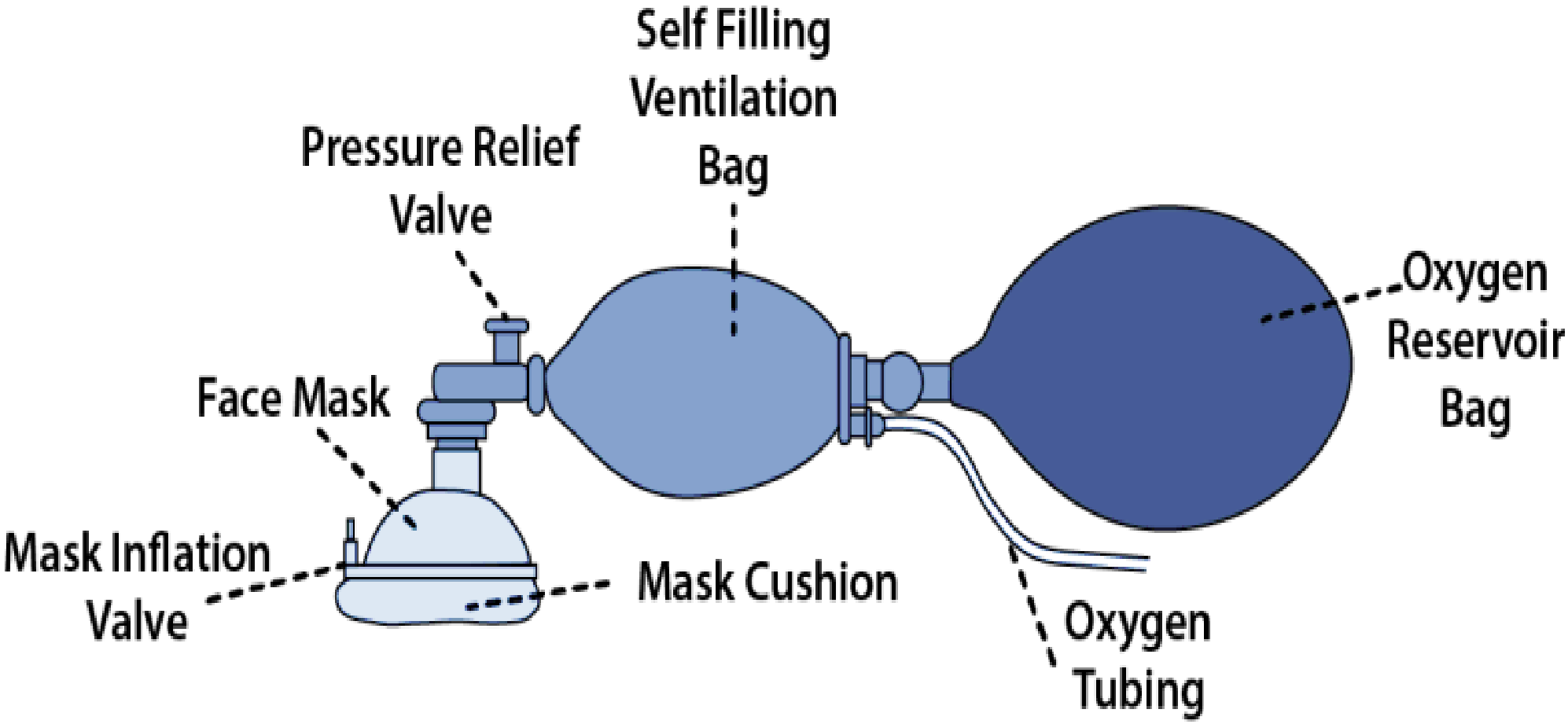


Image from https://airwayjedi.com/2017/03/26/manual-ventilation-self-inflating-vs-free-flow-bag/

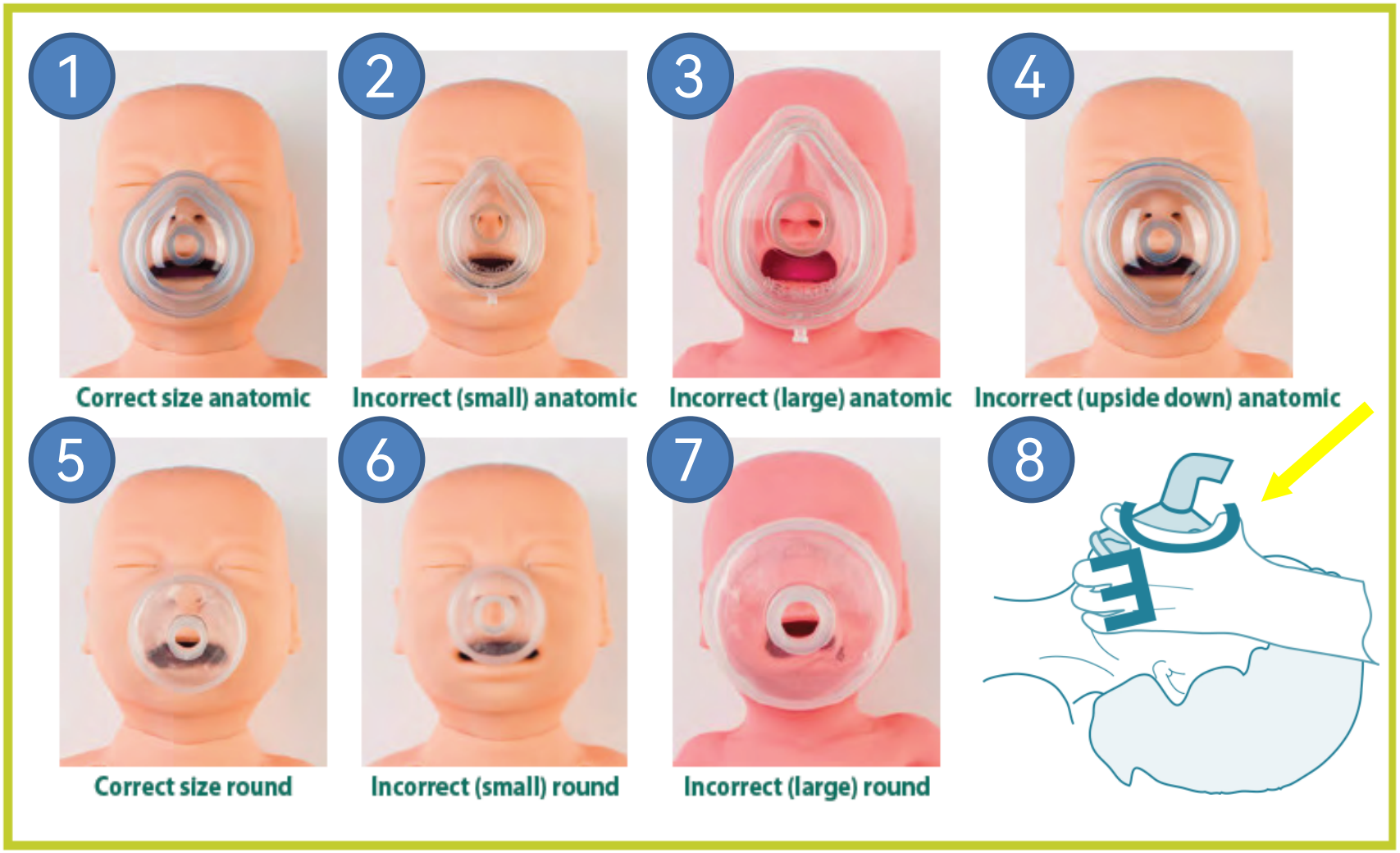
Steps/Sequence of Ventilation

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]

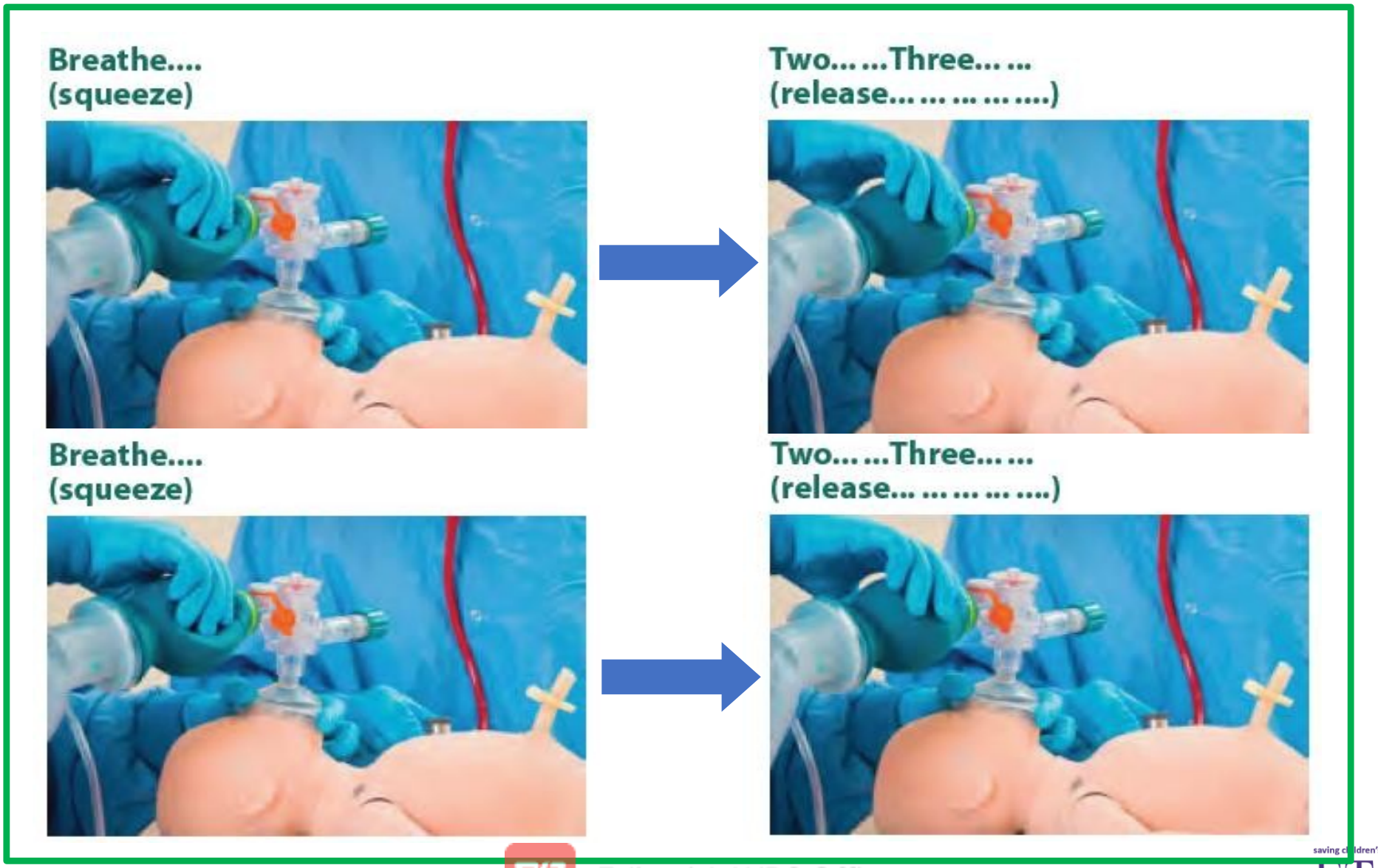
Initial Inflation pressure (PIP)

- **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

Ventilations – 40 – 60/min



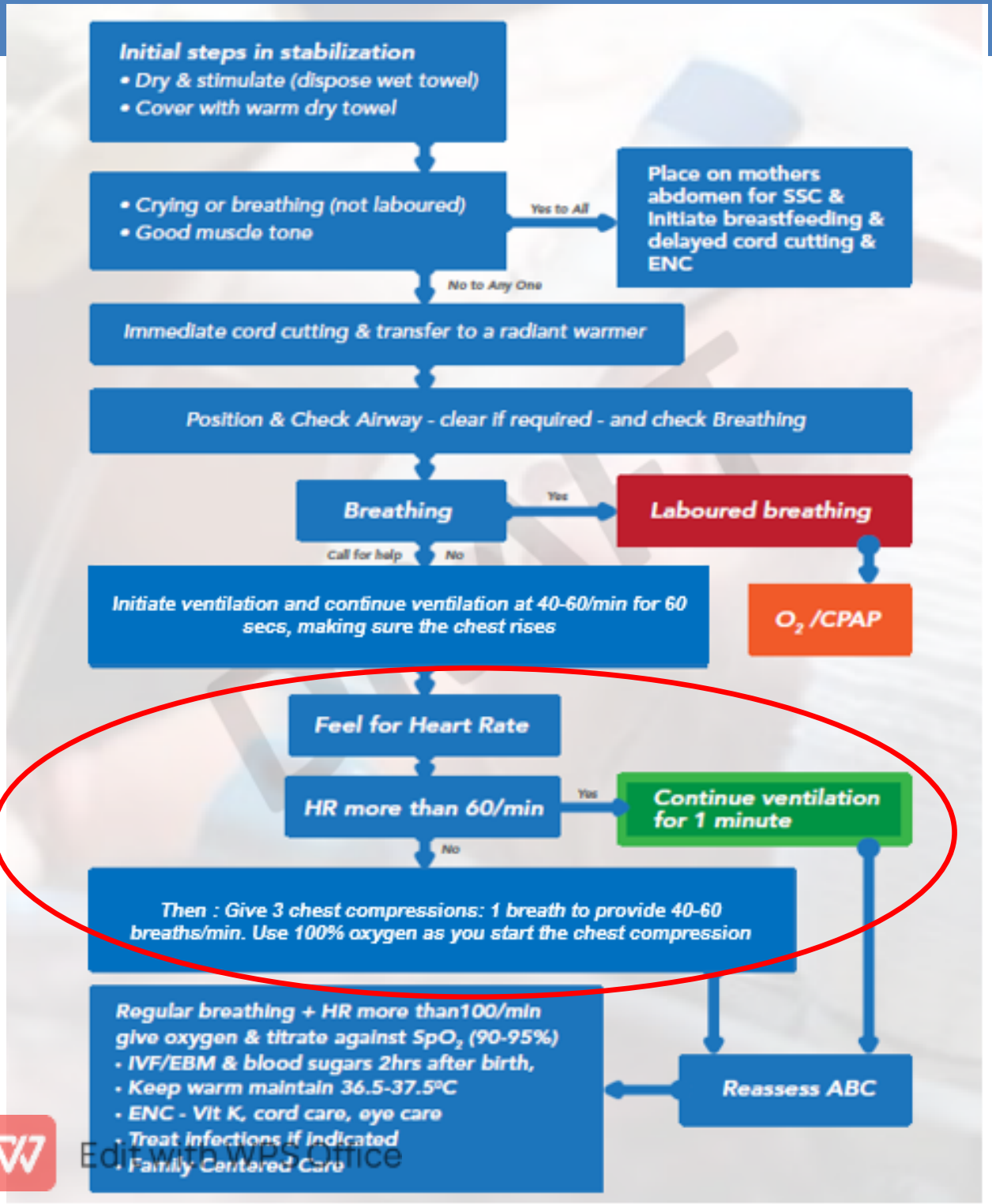
Images from Resuscitation and stabilization of babies born preterm. In: Weiner GM, Zaichkin J, eds. Textbook of Neonatal Resuscitation. 7th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2016:225–241https://clinicalgate.com/pediatric-emergencies-and-resuscitation/

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)

Circulation

Circulation



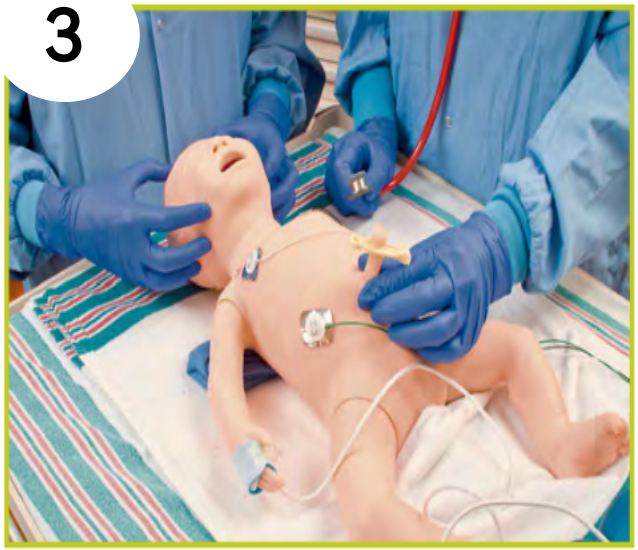
Circulation

- Assess heart rate

1 Umbilical cord

2 Stethoscope

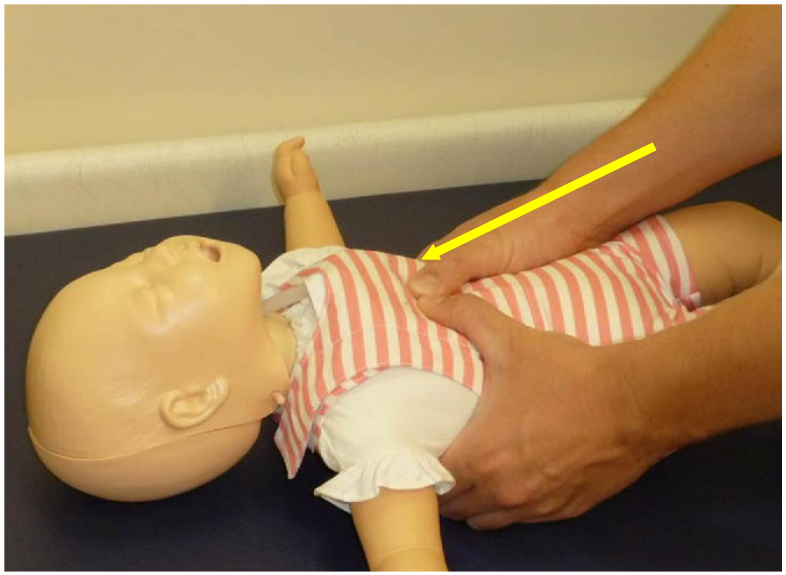
3 Pulse oximeter/ECG

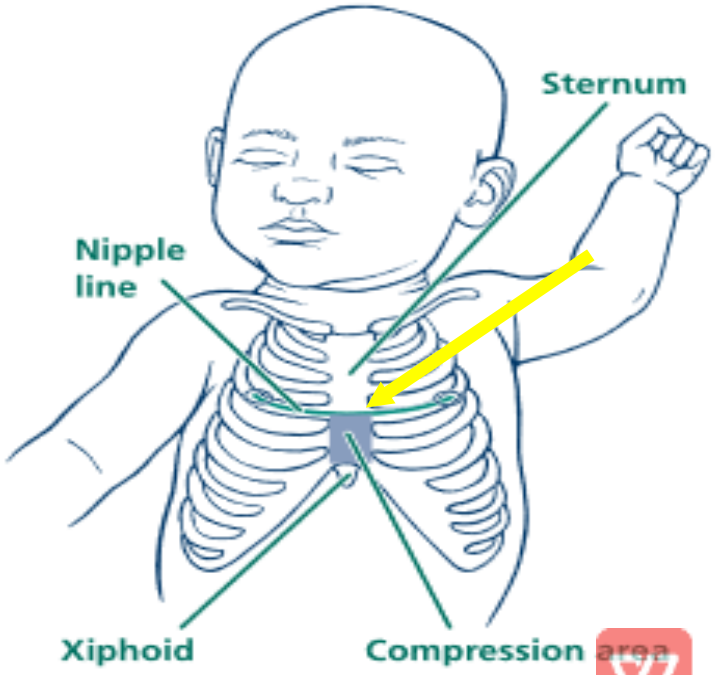


- Count HR over 5 – 10 seconds
- If estimated to be below 60/min – begin chest compression
- Initiate chest compressions only if 2nd rescuer available- ventilation should not be interrupted to provide compressions

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/b69fc74ba1e10861c8dd68f7b99f7677[illegible]/figure/0
Neonatal Resuscitation2015 American Heart Association Guidelines Update forCardiopulmonary Resuscitation and EmergencyCardiovascular Care

Principles of Chest compressions

One – and – two - and- three – and - breath

Image borrowed from https://www.semanticscholar.org/paper/Cardiopulmonary-resuscitation-(CPR)-related-rib-in-Franke

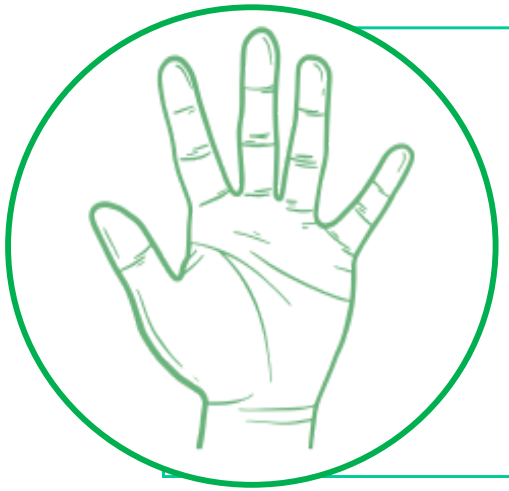
Why use two thumb- hand encircling technique?

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

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

Use of Drugs during Resuscitation

Use of Drugs in Newborn Resuscitation

- Most newborns improve without emergency medications.
- Before considering drugs, assess the effectiveness of **ventilation (first)** and (perhaps) **compressions**
- Drugs will usually need ECG monitoring
- 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!**

Target oxygen saturations

Target oxygen levels after birth

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

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

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

How to deliver oxygen

Bag Valve & Mask device Delivers 100% oxygen

Indications:

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

Non-Rebreather mask Delivers 85-100% oxygen

Indications:

- Post resuscitation
- **If develops apnea/ gasping - PPV using BVM**

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**

Questions?

Summary

1. To achieve good resuscitation we need;
    - Good clinical judgement
    - Practice evidence based care
    - Correct and proper use of equipment
2. All clinical procedure must be performed correctly

Neonatal Standards Of Care

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saving children's lives

ETAT+

Emergency Triage Assessement and Treatment plus admission

University of Nairobi

Keprecon

Kenya Paediatric Research Consortium

KENYA PAEDIATRIC ASSOCIATION

Objectives

- Review the newborn care quality statements
- Review components of essential (routine) newborn care in the immediate newborn period
- Review the use of CPAP in RDS

Newborn Care Quality Statements

- Ministry of Health statements on quality neonatal care.
- Adapted from WHO standards for improving quality of maternal and newborn care in health facilities.
- Addresses 7 domains

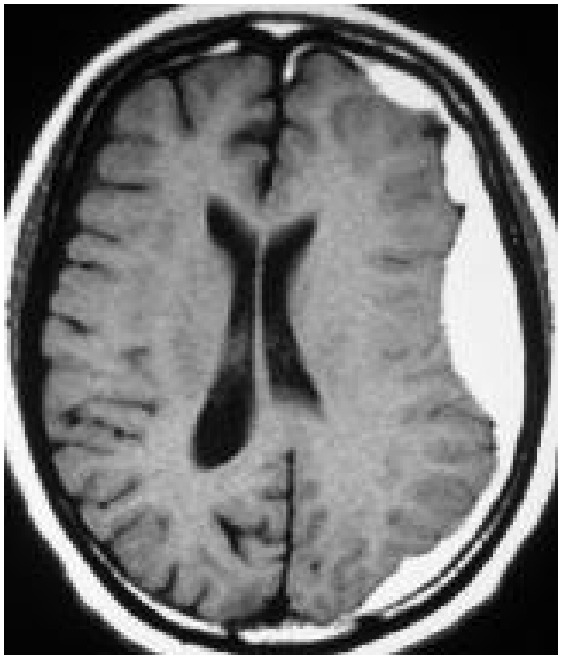
Newborn care quality statements

1. Evidence-based practices for routine care and management of complications
2. Support for successful breastfeeding
3. Care according to standard precautions for preventing hospital-acquired infections
4. Effective communication with mothers and their families
5. Use of essential newborn technologies
6. Actionable information systems
7. Functional referral systems

Components of essential newborn care in the immediate newborn period

Vitamin K

- Severe Vitamin K deficiency can result in Haemorrhage & Death
- Vitamin K IM given at birth prevents hemorrhagic disease of the newborn in neonates of all ages
- 0.5mg if weight < 1.5kg, 1mg if weight ≥ 1.5kg



Eye and Cord Care

- Eye Care:
  - Clean eyes immediately after birth from medial to lateral side with swab soaked in sterile water (Separate swabs for each eye)
  - Give TEO within 1 hour of birth

- Cord Care:
  - If infant born stable and active, Clamp the Cord 1-3 minutes after delivery.
  - Keep the cord clean;
  - Apply 4 % Chlorhexidine to the Cord daily

Chlorhexidine for Cord Care

- For hospital births (gestation >28 weeks, BWT >1 kg) apply 4% active Chlorhexidine to the Umbilical Cord
  - immediately after birth
  - daily thereafter till cord separates.
- Formulations and strengths
  - There are **gel**, powder or solution formulations
  - A concentration of 7.1% CHX digluconate delivers 4% of the active drug

Products examples. Photo: PATH/Mutsumi Metzler.

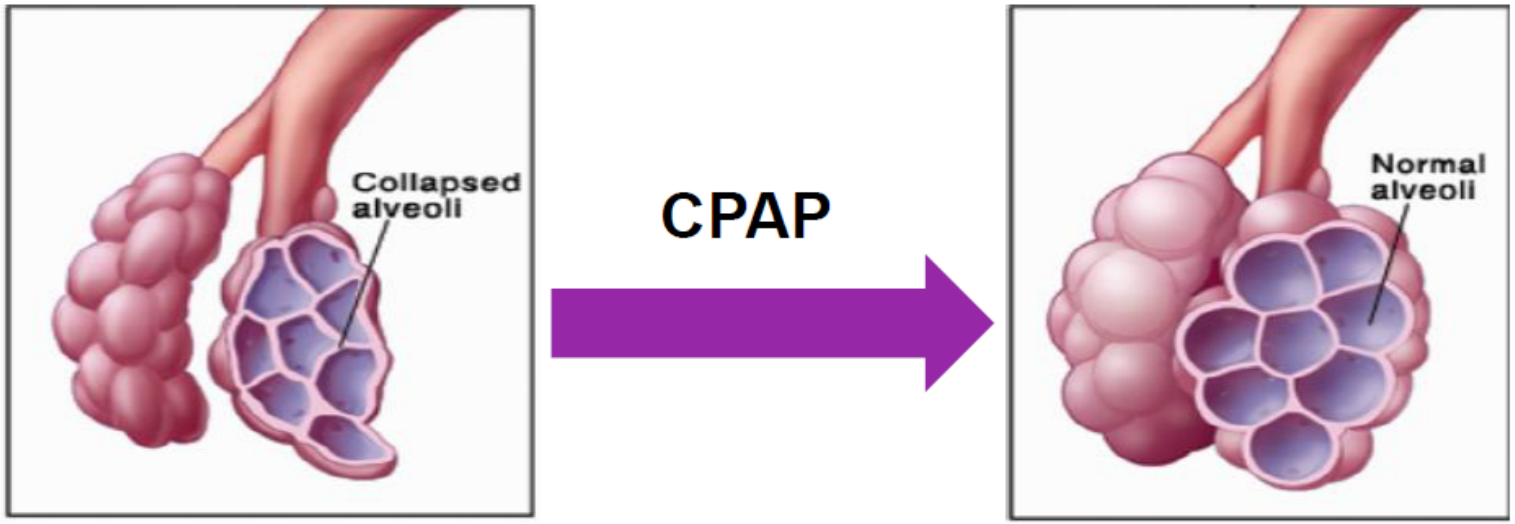
Continuous Positive Airway Pressure (CPAP) Ventilation

Proven effective intervention in newborns/neonates with respiratory distress syndrome (RDS)

Non-invasive method of oxygen administration (in comparison to mechanical ventilation) to

- continuously keep alveoli open during expiration
- reduce the work of breathing
- reduce risk of atelectasis and respiratory fatigue

Benefits of using CPAP Ventilation



1

Improves oxygenation

2

Continuous distending pressure keeps alveoli open which maintains FRC

3

Promotes Lung growth and development.

- Promote surfactant production

When to use CPAP Ventilation

Prophylactic versus Rescue CPAP

- **28-30 wks(1000-1300gms)**
- Initiated as soon as possible within the delivery room
- For the newly born with good cardiac activity and breathing spontaneously
- Not in respiratory distress
- Intended to avoid mechanical ventilation

- **Above 30 weeks(>1.3kgs)**
- Initiated after trial of oxygen therapy
- Neonate with increased work of breathing and SpO_2< 90% on nasal prongs at 1L/min

Questions?

Summary

- All newborns should have access to a clean, warm environment during and after delivery.
- All newborns should be attended to by skilled and competent health workers.
- Health facilities should provide supplies, materials, and drugs (Vit K, TEO, Chlorhexidine) for quality newborn care.
- Nasal CPAP, if initiated early, is associated with good clinical outcomes in neonates with severe respiratory distress.