

ADVANCED CRITICAL CARE MANAGEMENT IN AN EBOLA TREATMENT UNIT (ETU)

OPTIMIZED SUPPORTIVE CARE FOR EBOLA VIRAL DISEASE (EVD) PAEDIATRIC AND NEWBORN CARE

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ALIMA – The Alliance for International medical Action

<https://www.alima-ngo.org/en/tag/ebola>



Optimized supportive care for Ebola viral disease (EVD)

Paediatric and Newborn care

- Causes of maternal and child mortality
 - Ebola Viral Disease – basic background information
 - Optimized supportive of care for children with confirmed or suspected EVD
 - Care on different levels of a referral pathway
 - Clinical care in an ETU
 - Lessons learned during the Ebola outbreak in DRC – 2018- 2020
- => See specific presentation – regarding maternal care in an Ebola outbreak context



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Care of patients with suspected and confirmed Ebola Viral Disease (EVD) is equally important

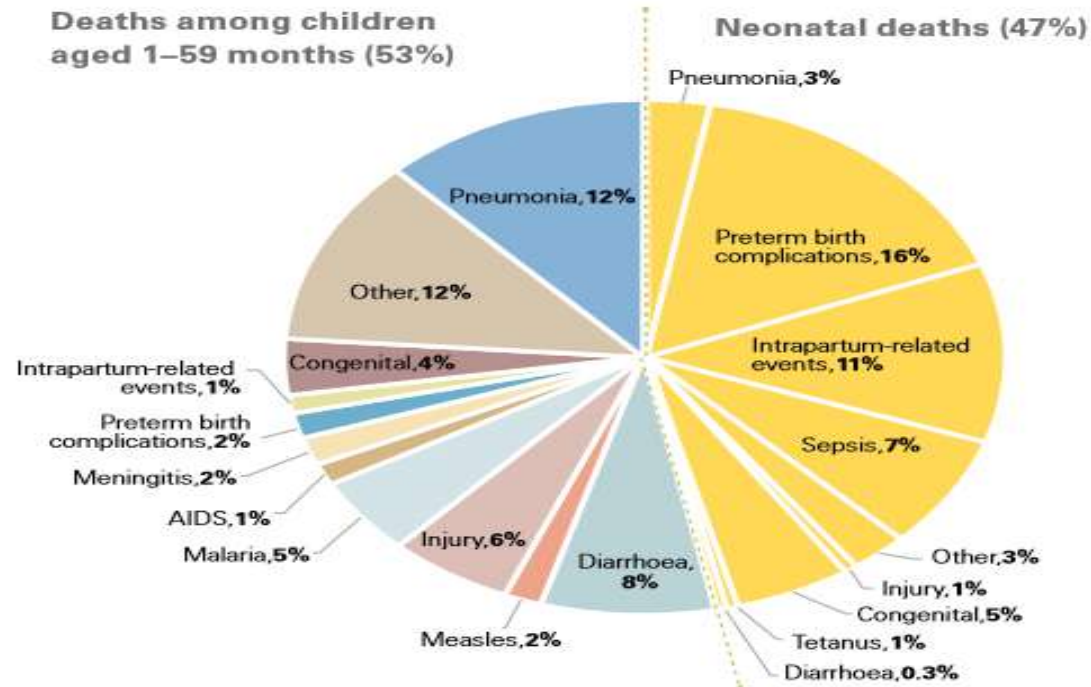


Common presentations in patients with suspected Ebola infections e.g.:

- Severe Respiratory infections
- Severe Malaria/sepsis
- Meningitis
- Diarrheal diseases
- Non- communicable diseases (e.g. DKA, sickle cell disease)
- TB/HIV
- Maternal care & Obstetric emergencies

Child mortality < 5 years – 5,3 Million deaths in 2018

A. Global distribution of deaths among children under age 5, by cause, 2018



Approximately 50% of deaths in children < 5 years are associated with undernutrition (SAM, MAM, chronic undernutrition).

Sepsis => a common cause of deaths among children

B. Global distribution of newborn deaths by cause, 2018

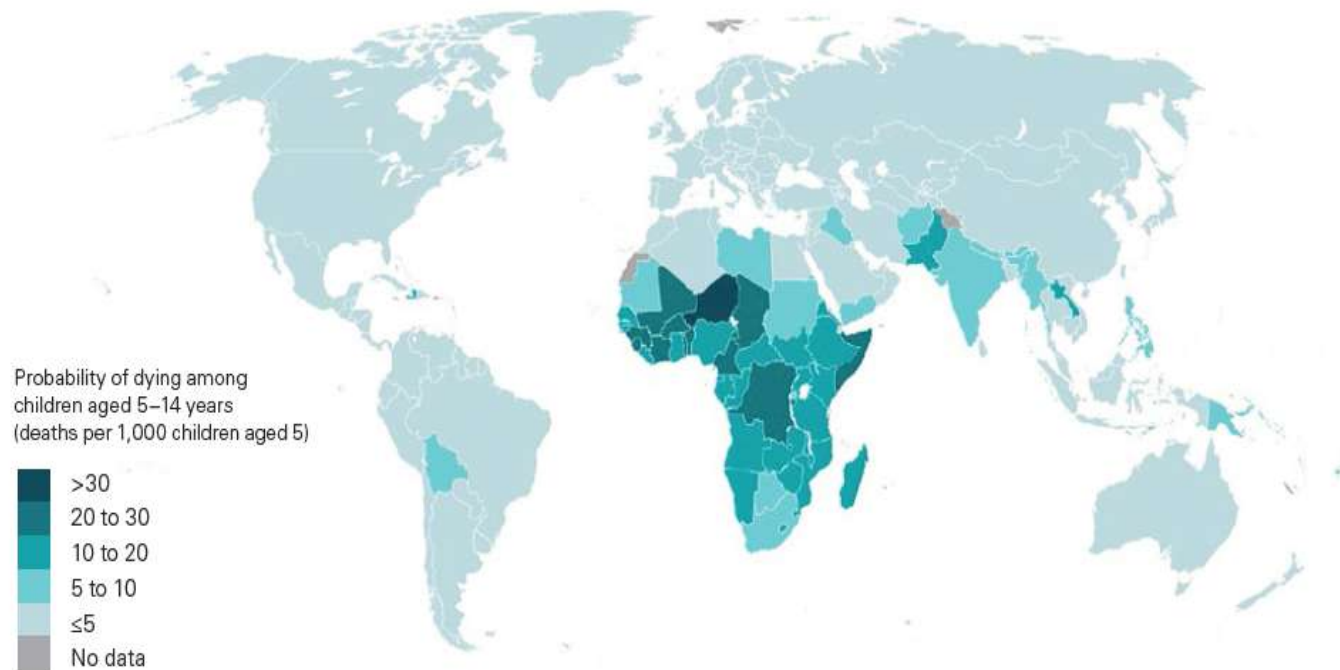


Children: 5-14 years – almost 1 Million deaths in 2017

MAP
3

Countries with the highest mortality among children aged 5–14 are concentrated in sub-Saharan Africa

Probability of dying among children aged 5–14 (deaths per 1,000 children aged 5) in 2017, by country



Causes of mortality:

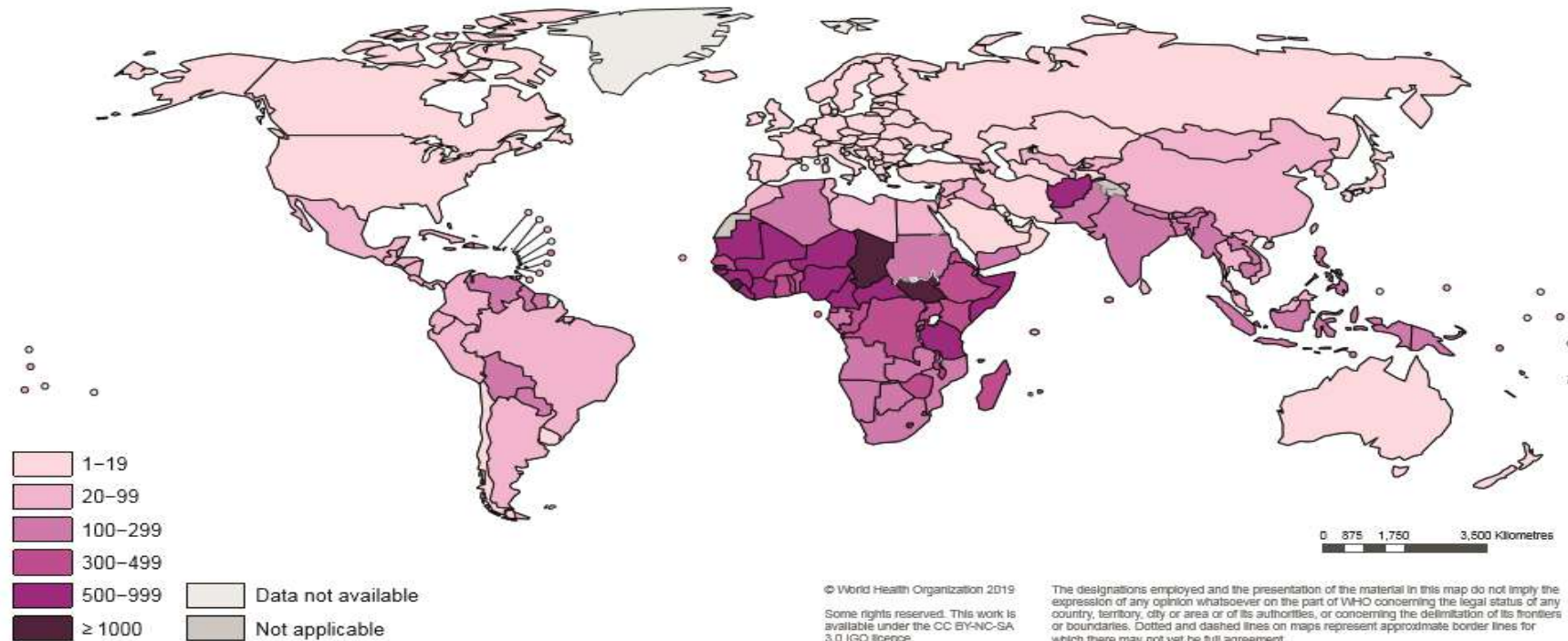
- Infections
- Trauma/ intoxications
- NCDs e.g.: Sickle Cell Disease, Asthma, Diabetes, Epilepsy, Malignancies

SRH becomes relevant in adolescents and young adults.

General health issues in Ebola contexts

Example: Global Maternal Mortality is unacceptably high

Figure 1. Maternal mortality ratios, by country, 2017



Causes of maternal mortality in the context of Ebola?
Ebola treatment units (ETU) need to be prepared for:

- Deliveries
- Obstetric emergencies e.g.: Post-partum haemorrhage, Sepsis, eclampsia
- Essential newborn hospital care

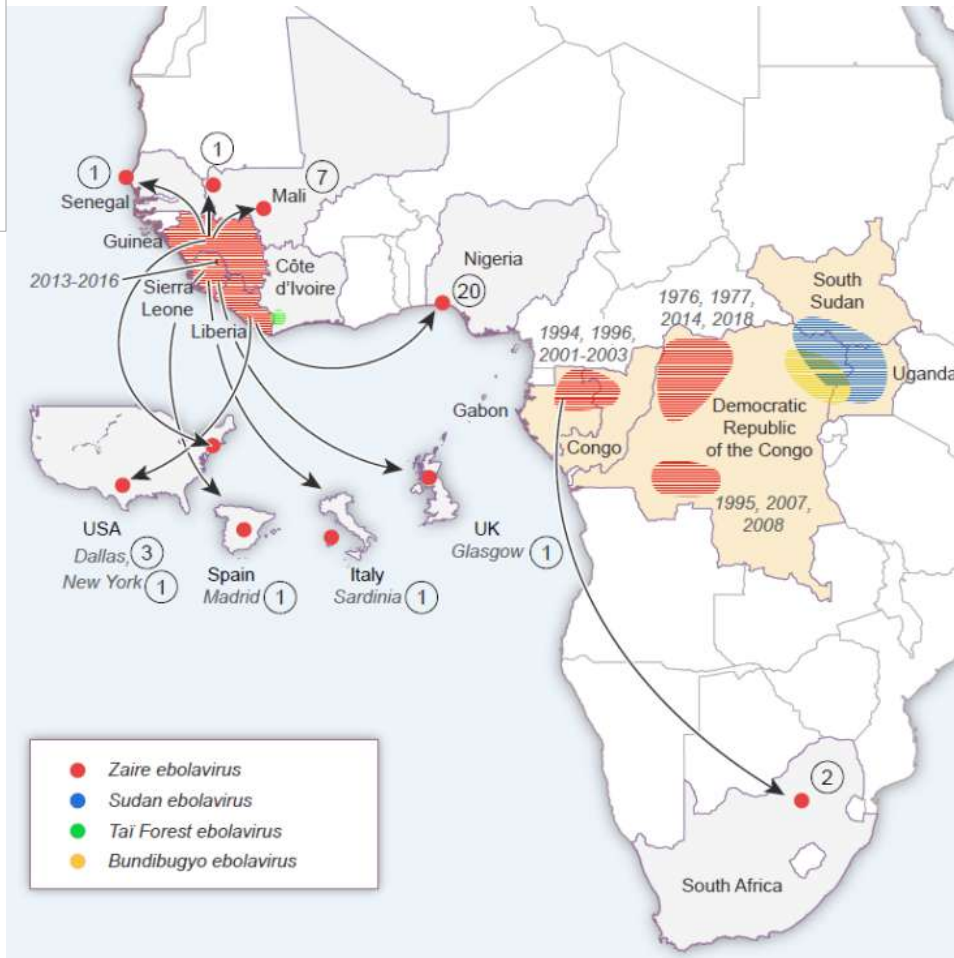
Reported Ebola outbreaks: 1976 → 2018/20

West- Africa 2013- 16

28,616 total cases

11,310 deaths

(WHO, September, 2016)



DRC 2018-2020

3481 total cases

2299 deaths

1162 survivors

In July 2020 the 11th Ebola outbreak was declared in province Equateur/DRC

14. February 2021

- Ebola cases confirmed in Guinea
- Sub-prefecture of Gouécké, Nzérékoré Region

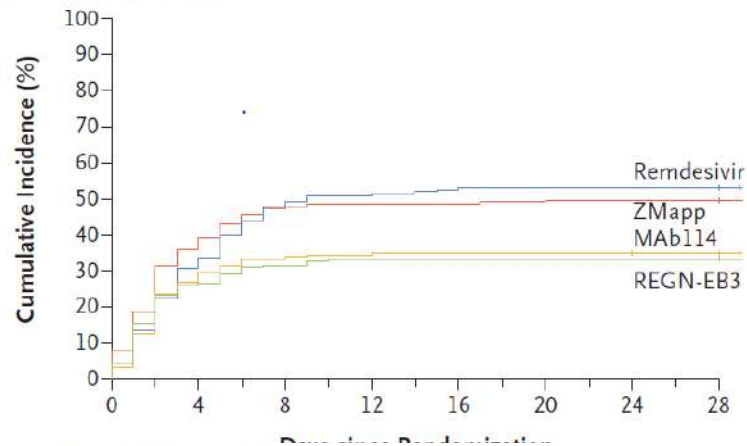
=> Outbreak response planning in progress: WHO, ALIMA, MSF etc.

PALM-Trial - Survival of patients with Ebola

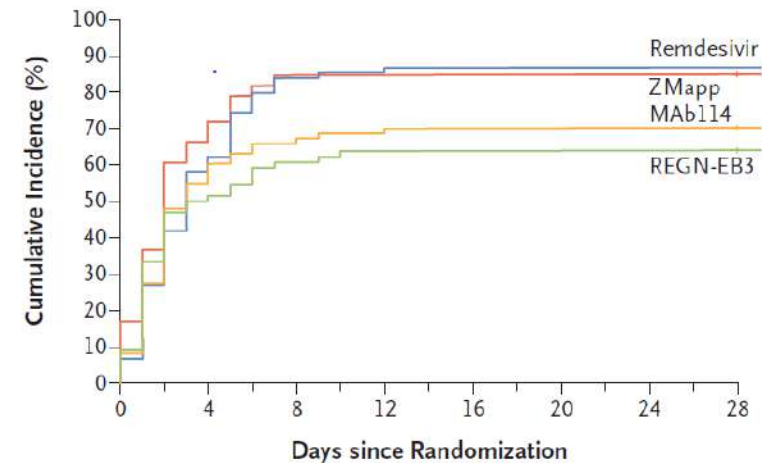
Start of supportive treatment and experimental medications

Mulangu, S., et al., A Randomized, Controlled Trial of Ebola Virus Disease Therapeutics. *N Engl J Med*, 2019.

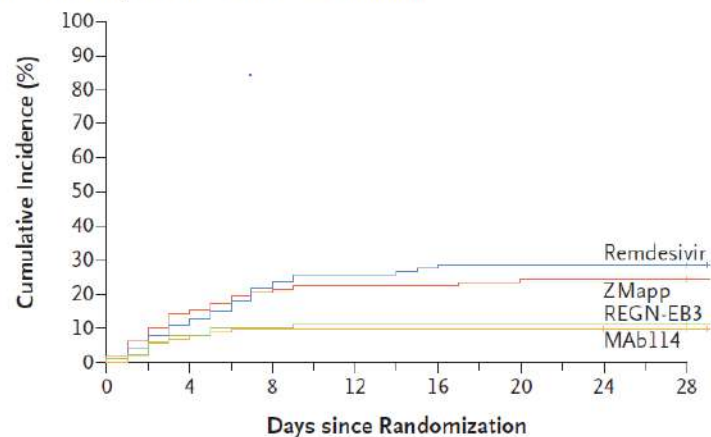
A Incidence of Death, Overall



B Incidence of Death, Patients with a High Viral Load



C Incidence of Death, Patients with a Low Viral Load



Patients with low viral loads + early start of treatment

=> Survival > 80%

+/- Vaccination before onset of the illness

Comprehensive, decentralized Ebola response

From the community to an Ebola Treatment Unit (ETU)

Community engagement



Surveillance & culturally sensitive contact tracing



Vaccination



Early start of symptomatic treatment in peripheral facilities



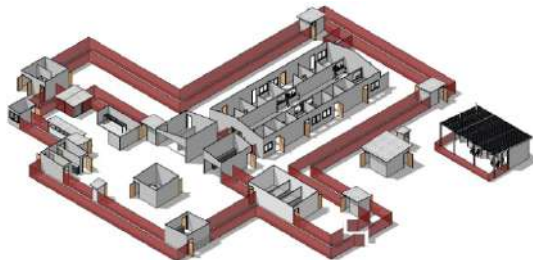
Ambulance services – safety & care



Psycho-social support & communication



ETU : Critical Care – adapted to contexts; close to affected populations
Curative & palliative care



Safe & dignified burial procedures



Improvement of quality of care in peripheral health facilities

Example: sustainable energy solutions in Ebola Transition Centers



Solar systems can provide electricity for:

- Oxygen concentrators & portable O2 concentrators
- Light
- Cold chain
- Water pumps



Transfer from communities or transition centers => Ebola Treatment Units

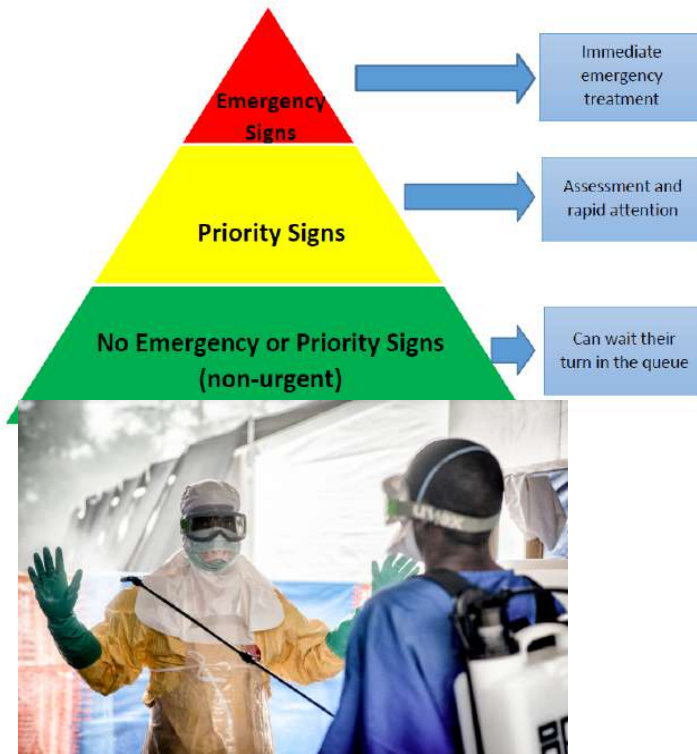


Some basic aspects to consider

- Pre-referral management in Ebola Transition Centers
e.g.:
 - Provision of O₂
 - Fluid resuscitation
 - Treatment of potential Malaria/bacterial infections
- Essential Equipment
 - Oxygen
 - “ABCDE” equipment
- Security
- Health workers need to respect IPC standards & use Personal Protection Equipment (PPE)

Emergency, Triage, Assessment & Treatment/ETAT *in the context of outbreaks highly contagious diseases* => e.g. Ebola, Lassa, Measels, Cholera, SARS-CoV2

Evaluation of Ebola risk

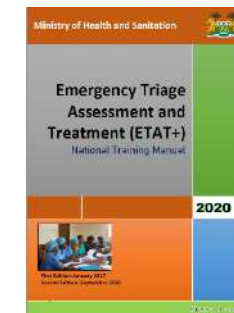
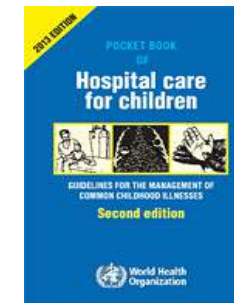


Most children who die in hospitals – die in the first 24- 72 hours.

Paediatric hospital mortality can be reduced with the set-up of an efficient patient circuit => Triage & Emergency care

A patient circuit needs to be prepared for outbreak control.

Infection prevention & control measures are needed – including personal protection equipment (PPE).



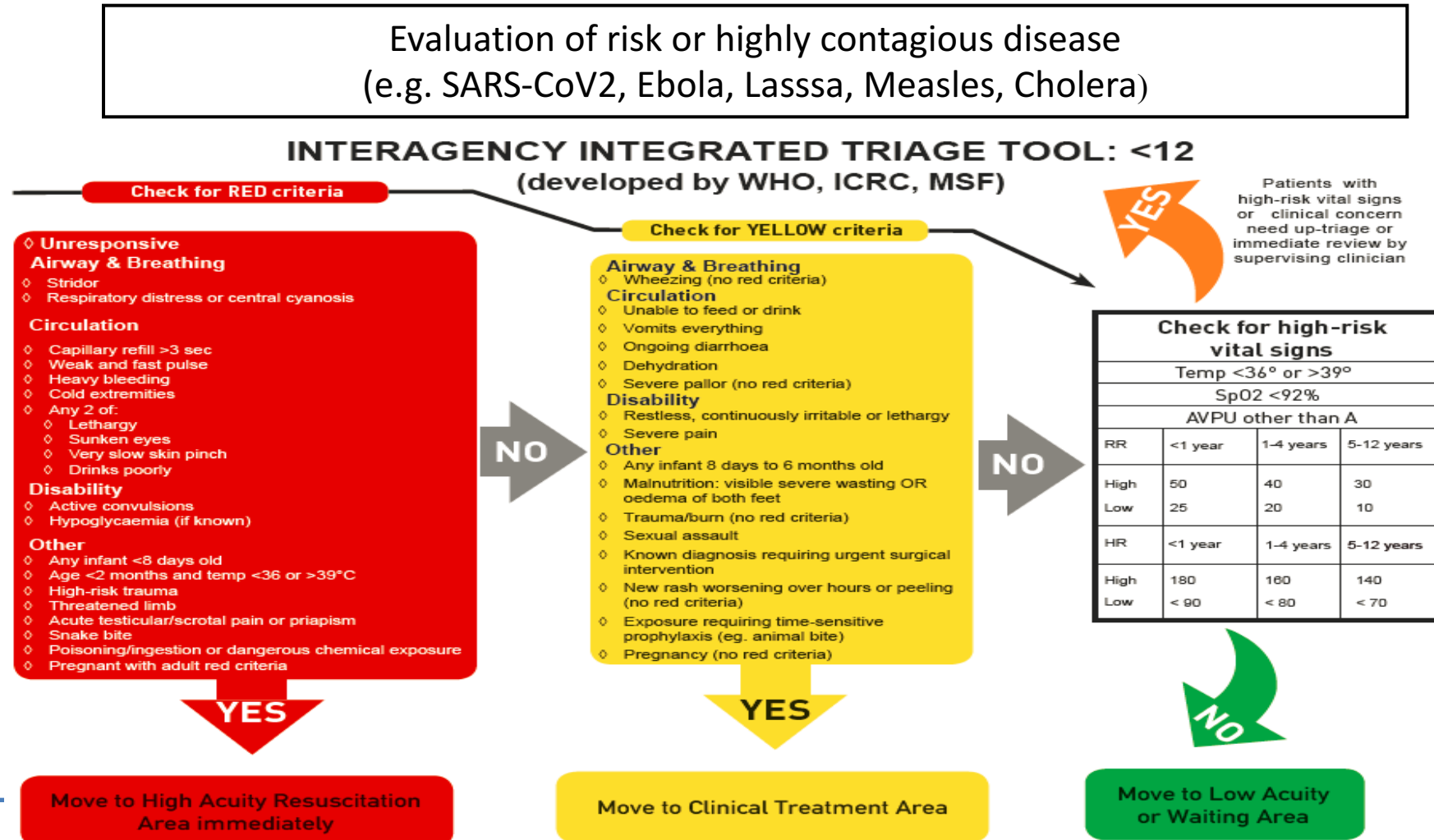
Treatment of critically ill patients with suspicion of EVD

Biosecurity and Infection Prevention Control (IPC)



- **Vaccination for health workers (clinical and non- clinical)**
 - Health facilities & ETUs need efficient design
 - Training of health workers
- ⇒ IPC- measures
- ⇒ Appropriate Personal Protection Equipment (PPE)
- ⇒ Prevention and control of nosocomial infection => Ebola and non-Ebola infections
-
- Management of biomedical equipment, laboratory samples etc.
 - Waste management

New Triage Tool « *Interagency* » (WHO, ICRC, MSF + partners)



Mariam - 3 years old

Living near Mambassa/Ituri in DR-Congo



- Mariam has fever since 3 days.
- Yesterday evening she became increasingly lethargic and had some diarrhea.
- This morning she had a convulsion.
- A family member recently died with an acute febrile illness. Her mother attended the funeral.
- The mother rushes to the hospital5 km to walk.
- Is Mariam at risk to have Ebola viral disease?

Mariam - 3 years old

Living near Mambassa/Ituri in DR-Congo



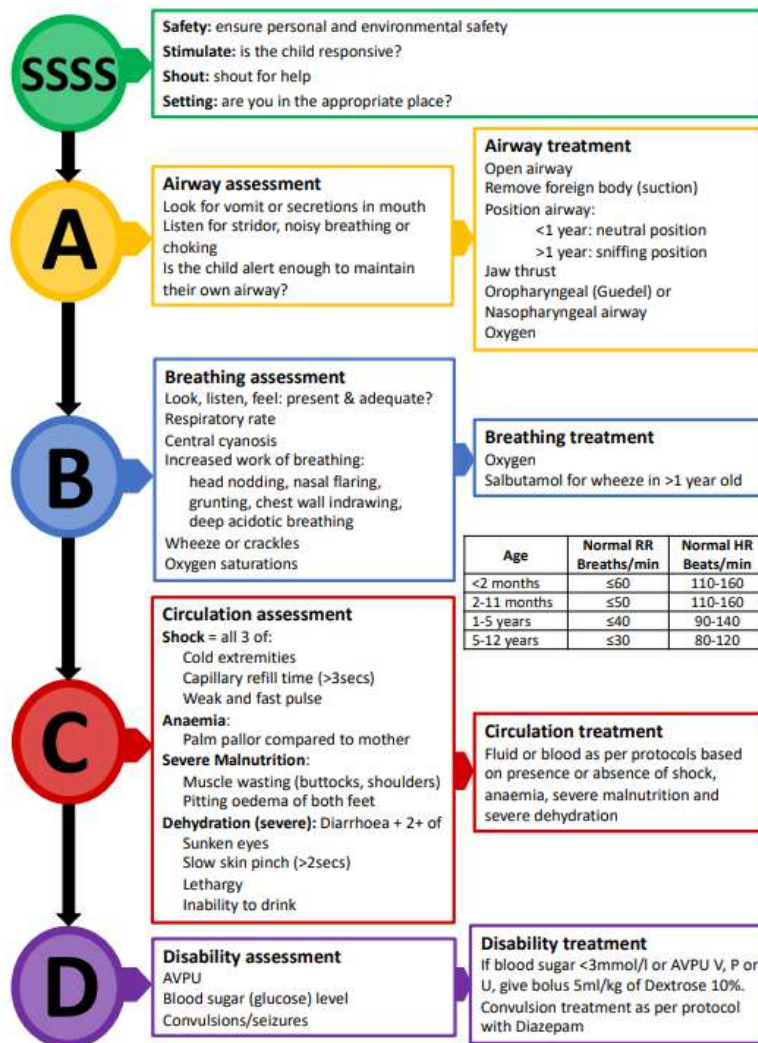
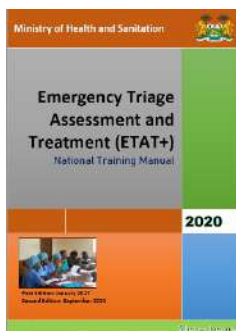
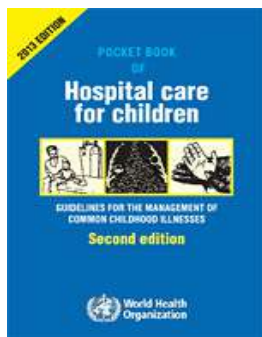
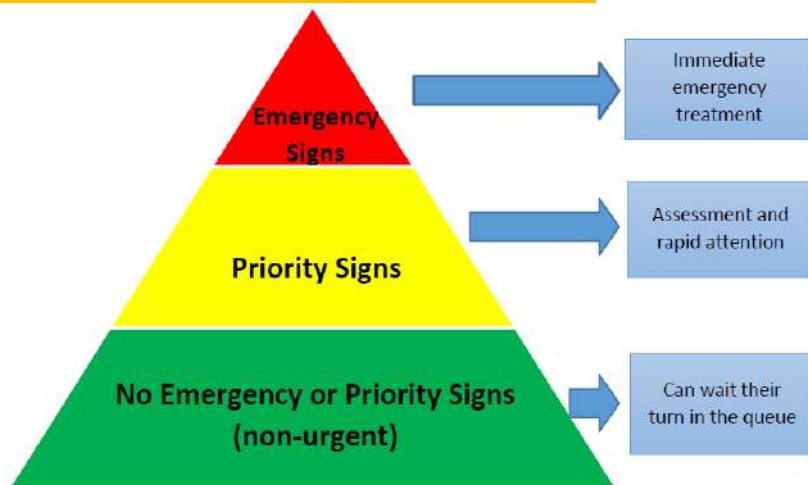
On arrival to the hospital – Triage/ER zone

- Generalized Convulsion
- Airway – secretions +++
- Breathing – poor respiratory effort
- Circulation
 - Cold peripheries, CRT -4 sec, weak & fast pulse
 - Pallor
 - No dehydration
- Disability - Generalized convulsion

What to do?

Treatment of a critically ill child with suspicion of EVD

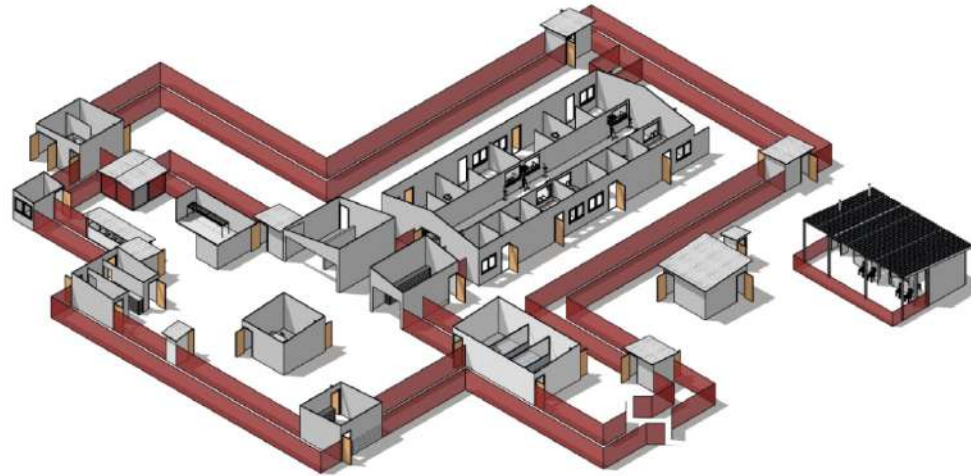
Evaluation of Ebola risk



Hypoglycemia- correction:
New international guidelines
⇒ 2ml/kg- Dex 10%

Well designed Ebola Treatment Units => *Allow patient centered & more advanced critical care*

Triage



Patient circuit – for confirmed and suspected cases of EVD

Triage

Emergency zone/department

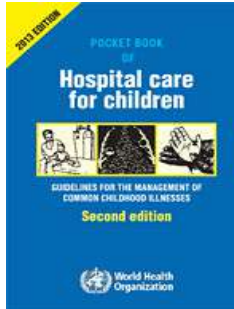
ICU for patients with highly contagious diseases

Access to

- ⇒ Maternal emergency services
- ⇒ Neonatal care
- ⇒ Surgical services & Trauma care

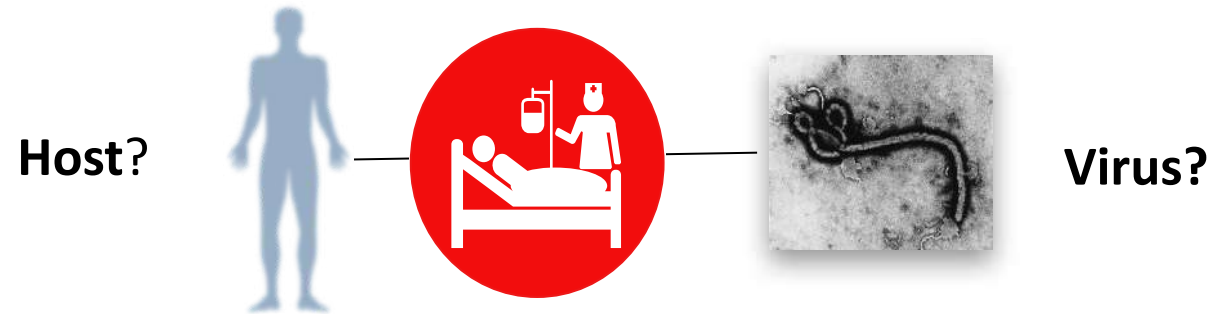
General hospital services =>
Paediatrics, Adults units

Optimized Supportive Care
for Ebola Virus Disease
CLINICAL MANAGEMENT STANDARD OPERATING PROCEDURES



Ebola Viral Disease (EVD)

Clinical presentation & host-pathogen interaction



After initial non-specific symptoms –
EVD can progress rapidly to Multi- Organ- Dysfunction.

Early initiation of essential critical care improves outcomes.



**Optimized Supportive Care
for Ebola Virus Disease**

CLINICAL MANAGEMENT STANDARD OPERATING PROCEDURES

Host- pathogen interaction in Ebola Viral Disease (EVD)

Progress to multi-organ- dysfunction



| Organ dysfunction | Details | Comments |
|----------------------|--|---|
| Respiratory problems | ARDS; Fluid resuscitation | Usually later in the disease process |
| Circulation | GI losses +/- GI bleeding; « Capillary leak »; Sepsis | One of the major problems in patients with EVD |
| Haemorrhage | DIC +/- Liver dysfunction | Not present in all patients |
| Encephalopathy | Viral encephalitis Intracranial haemorrhage Ischaemic lesions | Associated with poor prognosis |
| Liver & pancreas | Raised Transaminasis & Amylase +/- liver failure | |
| Acute kidney injury | Pre- renal causes; Direct impact of the virus | Severe AKI – associated with increased mortality risk Basic approaches to AKI can improve outcomes |
| Rhabdomyolysis | Potentially associated with AKI | |
| Co- infections | Pneumonia, Sepsis, Malaria, nosocomial infections | Early, pro- active treatment |

Optimized Supportive Care for EVD

« Context- adapted critical care » - Examples

- Oxygen; Non- invasive Respiratory support (e.g. bubble CPAP; HFNC)
- Fluid resuscitation using electrolyte balanced fluids
- Safe blood transfusions – Availability of fresh frozen plasma would have been beneficial in some settings
- Low- dose Adrenaline/Noradrenaline infusions and adequate monitoring
- Neuro critical care (e.g. management of status epilepticus)
- Context adapted management of acute kidney injury
- Nutrition of the critically ill patient
- Use of Point of Care Ultrasound (POCUS)
- Communication => psychological support

Administration of Regeneron EB3 or MAB114 => doses according to weight
Careful => infusion volumes
=> See specific presentation



Respiratory failure

Supplemental O₂



O₂ flow of 1-4 L/min via nasal cannula gives an FIO₂ of maximum 35- 50%
=> depending on the size of the child.

Observe the SpO₂ => targets in critically ill children:

- > 90% in children with severe pneumonia
- > 94% in critically ill children with multiple organ- dysfunctions

Humidification is only needed
if > 4l/min are used for > 1-2
hours.

*For neonates humidification
can be started at lower flows.*



O₂- flow: 5- 10 L/min – flow needs to humidified.

FIO₂ around 40-60% - depending on the size of the child.

Masks are often not well tolerated in young children.



Mask with reservoir

Flow of at least 10-15 L/min is needed.

FIO₂ > 70-80%

Low SpO₂ & severe respiratory
distress => despite supplemental O₂
What to do?

Improved non- invasive respiratory support

Example - Bubble CPAP



| Oxygen / Air Mixing Chart | | | | | | | | | | |
|--|---|------|------|------|------|------|------|------|------|------|
| Air Flowmeter (lt/min) | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Oxygen Flowmeter | 1 | 95.0 | 57.5 | 45.0 | 38.8 | 35.0 | 32.5 | 30.7 | 29.4 | 28.3 |
| | 2 | 95.0 | 70.0 | 57.5 | 50.0 | 45.0 | 41.4 | 38.8 | 36.7 | 35.0 |
| | 3 | 95.0 | 76.3 | 65.0 | 57.5 | 52.1 | 48.1 | 45.0 | 42.5 | 40.5 |
| | 4 | 95.0 | 80.0 | 70.0 | 62.5 | 57.5 | 53.3 | 50.0 | 47.3 | 45.0 |
| | 5 | 95.0 | 82.5 | 73.0 | 66.9 | 61.7 | 57.5 | 54.1 | 51.3 | 48.8 |
| | 6 | 95.0 | 84.3 | 76.3 | 70.0 | 65.0 | 60.3 | 57.5 | 54.6 | 52.1 |
| | 7 | 95.0 | 85.6 | 78.3 | 72.5 | 67.7 | 63.8 | 60.4 | 57.5 | 55.0 |
| | 8 | 95.0 | 86.7 | 80.0 | 74.5 | 70.0 | 66.2 | 62.9 | 60.0 | 57.5 |
| Assuming an oxygen concentrator output of 95% Oxygen | | | | | | | | | | |

Bubble CPAP devices need to fulfill the following characteristics:

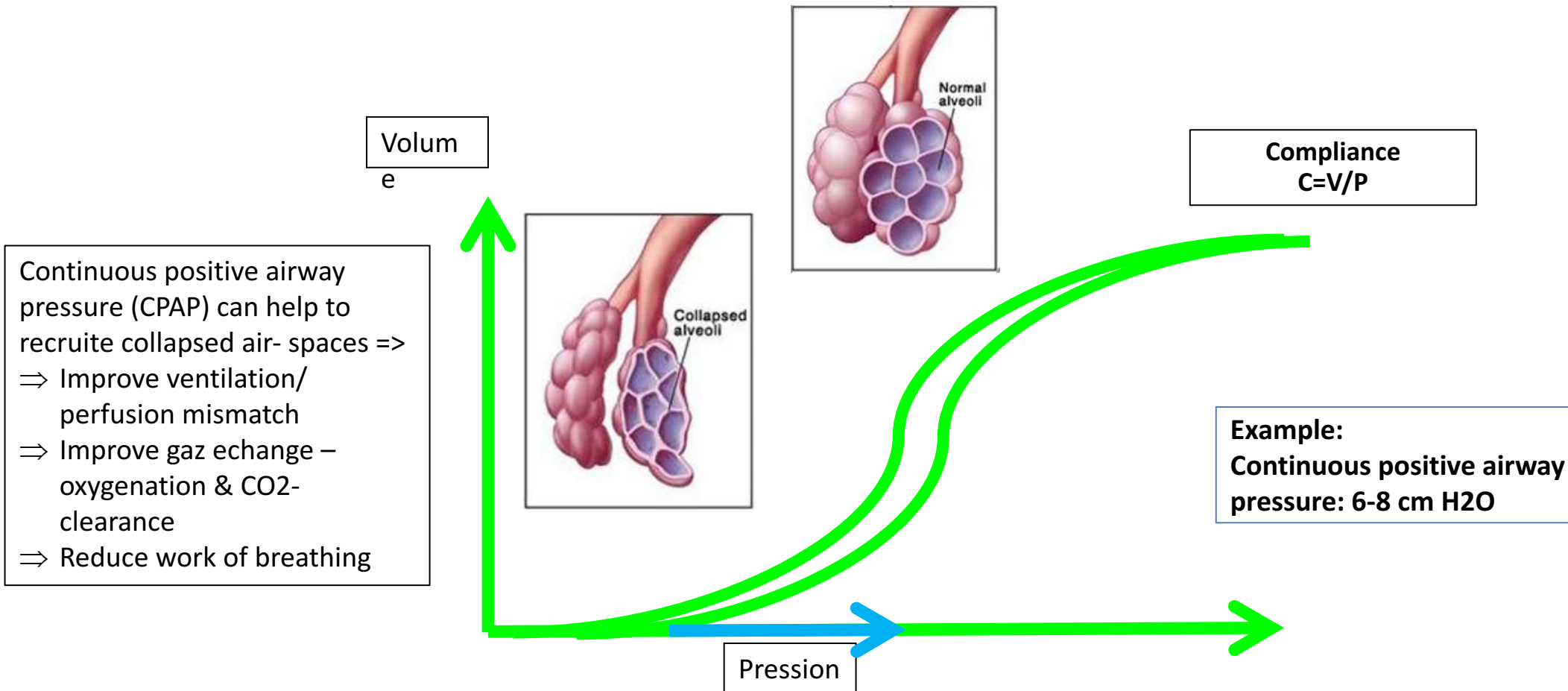
- Adequate flow: 1,5-2 Litres/min/kg
- O₂- concentration (FIO₂) needs to be adaptable
- Especially in premature neonates the SpO₂ need to be monitored in order to reduce oxygen toxicity (e.g. retinopathy of the newborn)
- Adequate prongs and tubings complying with « standard bubble CPAP set-up »
- Reliable adaptation of CPAP – pressure

Falk, M., et al., *Infant CPAP for low-income countries: An experimental comparison of standard bubble CPAP and the Pumani system*. PLOS ONE, 2018.

Baldursdottir, S., et al., *Basic principles of neonatal bubble CPAP: effects on CPAP delivery and imposed work of breathing when altering the original design*. Archives of Disease in Childhood - Fetal and Neonatal Edition, 2020.

CPAP – How does it work?

Pression positive continue des voies aériennes (CPAP)



Basic non-invasive respiratory support

Example: HFNC – High flow nasal cannula O2

- Air / Oxygen- flow
- Air/O2 flow is humidified and warmed – « conditioned »
- 0-10 kg: 2 LPM / kg
- > 10 kg: + 0,5 LPM / kg
- Adults – up to 40-60 litres / min

Mechanism

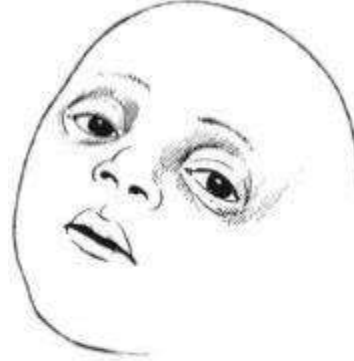
- CPAP effect
- Improving CO2 clearance



Milési C, *et al.* A multicenter randomized controlled trial of a 3-L/kg/min versus 2-L/kg/min high-flow nasal cannula flow rate in young infants with severe viral bronchiolitis (TRAMONTANE 2). *Intensive Care Med* 2018
Milési C, *et al.* Is treatment with a high flow nasal cannula effective in acute viral bronchiolitis? A physiologic study. *Intensive Care Med* 2013;
Milési C, *et al.* High-flow nasal cannula: recommendations for daily practice in pediatrics. *Ann Intensive Care* 2014

Evaluation of signs of shock and treatment

Which important information do we need?



Sunken eyes



Signs of haemorrhage => see *Trauma session*

Signs of Shock:

- Weak pulses
- CRT > 3 sec
- Cold extremities – temperature gradient

Check also for:

- *Pallor*
- *Signs of dehydration*
- *Nutritional status*

Management of shock – no access to “advanced ICU-care”

Example – paediatrics & WHO- guidelines

Shock, no dehydration e.g.: Severe Malaria, Sepsis
Particular care in children with neurological conditions
10ml/kg, 30- 60 min, max. 30 ml/kg - or just maintenance

In severe anaemia: No pre- transfusion bolus



Oral/enteral rehydration in less severe cases with ORS/RESOMAL:

- Plan A
- Plan B

**Careful with Resomal in massive diarrhea – risk of hyponatremia*

Severe acute Malnutrition & severe dehydration

10ml –15ml/kg, max. 30 ml/kg

Severe dehydration, no severe acute Malnutrition

Plan C: 30ml/kg and 70ml/Kg (over 3 -6 hours)?

Gastro - Intestinal - fluid loss is a major challenge in EVD

Importance of electrolyte balanced resuscitation fluids

- Hypercholaeremic acidosis after fluid resuscitation with Normal Saline might worsen outcomes
- Electrolyte balanced solutions should be used (e.g. Plasmolyte)
- POCUS can help to guide => fluid management, transfusions and use of low- dose inotropes/vasopressors.



Management of severe anaemia

Some considerations for children with EVD in malaria endemic contexts



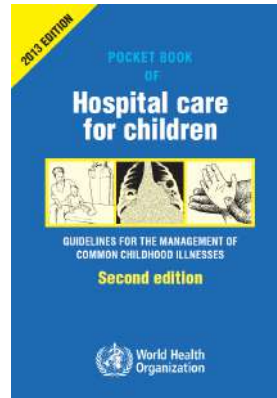
Laboratory services – priorities:

- Point of care test: Blood sugar, HB, MRDT, *sickle cell tests*
- SAFE Transfusion services - Consider logistics and supplies (e.g. Penta-bags)

Severe anaemia => No pre-transfusion fluid bolus if no signs of dehydration

- Transfusion threshold if signs of „decompensation“ => HB 6g/dl
- Non-malnourished child:
=> 15 – 20ml/kg (Packed red blood cells/ whole blood) – over 3-4 hours
- Child with SAM:
=> 10 ml/kg in children with SAM – over 3 hours

Careful – Monitor HB in critically illness => some children might need a second transfusion



Treat the child and not only the HB- value

- Some children might already need transfusion if HB is > 6g/dl – especially if further haemolysis is anticipated.
- Fresh frozen plasma +/-platelet concentrates might be beneficial => in some contexts

APPENDIX 3. MANAGEMENT OF SHOCK SYNDROME IN EBOLA VIRUS DISEASE

Health care worker has to wear full set of PPE: scrubs, boots, long-sleeved gown, mask, eye protection (face shield or goggles), head cover, apron, double gloves

Shock features in children (all three features)

1. Delayed capillary refill > 3 seconds AND
2. Weak, fast pulse AND
3. Cold extremities

OR hypotension (LATE finding)

| Age | < 1 month | 1–12 months | 1–12 years | > 12 years |
|-----------|-----------|-------------|----------------|------------|
| SBP mm Hg | < 50 | < 70 | 70 + (2 x age) | < 90 |

Caution in children

Rapid fluid therapy may be harmful if there is severe dehydration, anaemia (Hct < 0.15 or Hb < 50 g/l) or malnutrition*

Paediatric patient: 10–20 ml/kg over 30–60 minutes

SpO₂ < 94%

Yes

No

Monitor for fluid overload

Fluid resuscitation
Use crystalloid: Ringer's lactate or normal saline

Insert intravenous (IV) or intraosseous (IO) line safely

Give initial fluid bolus

Shock features in adults

- SBP < 100 mm Hg, HR > 90/min
- Signs of hypoperfusion:
 - » Delayed capillary refill > 3 sec
 - » Cold extremities
 - » RR > 22/min
 - » Decreased urine output (< 0.5 ml/kg/hr)
 - » Altered mental status
 - » Elevated lactate

- Give oxygen therapy immediately to maintain SpO₂ > 94%
 - » Face mask with reservoir bag at 10–15 l/min
 - » Use nasal cannula in children
- DO NOT share nasal prongs
 - » Oxygen delivery devices are for single use

Adult patient: 1 litre over 15–30 minutes

Management of fluid refractory shock

Vasopressors & Inotropes & the role of POCUS

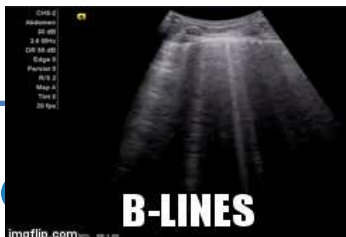
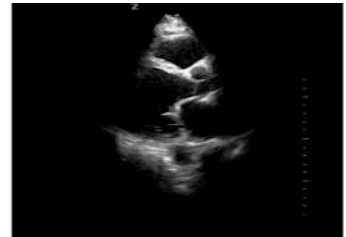
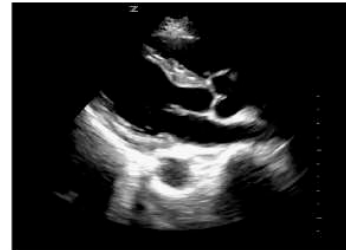


Manage Airways and respiration + O2 +/- NIV
Correction of anaemia
Correction of hypoglycemia and electrolyte abnormalities (e.g. ionized Calcium)

**See detailed infusion tables and drug calculations*

- Large vein access (16–18 gauge catheter) or IO line or central venous catheter.
- Appropriate dilution in selected carrier and precise delivery mechanism, such as infusion pumps.
 - » For adults: noradrenaline 4 mg = 4 ml of 1:1000; adrenaline 4 mg = 4 ml of 1:1000 (80 mcg/ml concentration)
 - add 4 ml to 46 ml of D5W to make 50 ml
 - place in syringe driver
 - 0.1 mcg/kg/min is the starting dose. Usual maintenance dose 0.25–0.5 mcg/kg/min. Maximum dose 0.5–0.75 mcg/kg/min.
 - » For children: use more diluted solutions because the volumes infused are lower, especially for children under 30 kg. Adrenaline 1 mg = 1 ml of 1:1000; noradrenaline 1 mg = 1 ml of 1:1000
 - add 1 ml to 49 ml of D5W to obtain 50 ml (20 mcg/ml concentration)
 - place in a syringe driver
 - 0.1 mcg/kg/min at initial flow rate for adrenaline and norepinephrine. Usual maintenance dose 0.25–0.5 mcg/kg/min. Maximum dose 0.5–0.75 mcg/kg/min.

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Treatment of SE/RSE management in ETUs

ABCDE + Oxygen + Check Blood Sugar - Call for HELP!

**1. Line
ASM**

Diazepam 0.3 mg/kg IV/IO –max.
10mg or Lorazepam

**If no IV/IO line available
Buccal/IM Midazolam
Or rectal Diazepam**

Diazepam 0.3 mg/kg IV/IO –max.
10mg or Lorazepam

**2. Line
ASM**

Levetiracetam (40mg/kg)
Consider also as 1. Line ASM

**SE refractory to 2nd line ASM In high resource
settings =>
Intubation & ventilation + further management**

**SE refractory to 2nd line ASM & no option for
mechanical ventilation =>
Role of Ketamine – to be explored?**

Time since the onset of the
seizures

5 minutes

**10- 15
minutes**

**25-30
minutes**

Pregnancy and EVD

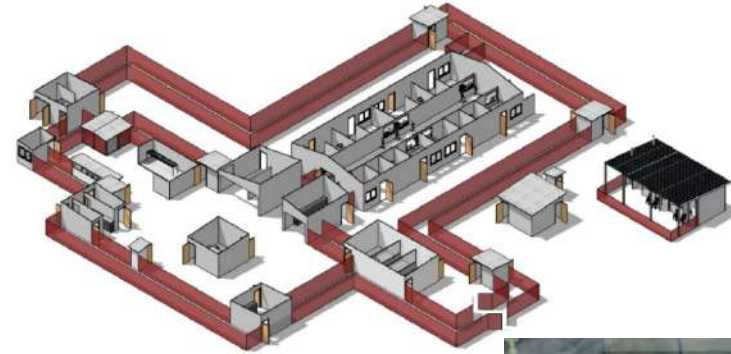
ETUs need to be prepared for the care of pregnant women & newborns

Preparation for:

- Normal delivery (+ Vacuum extraction)
- Caesarean section
- Neonatal resuscitation and care
- Obstetric emergencies e.g.:
 - Post partum haemorrhage
 - Eclampsia
 - Sepsis/Malaria

Team work:

- Surgical & Obstetric teams
- Anaesthetists or anaesthetic trained health workers
- Nurses and doctors need to be trained in essential neonatal resuscitation & neonatal care

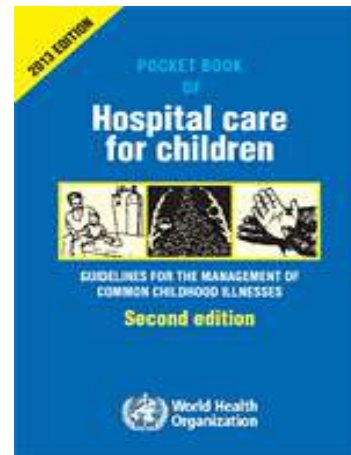


Main causes of neonatal mortality



Main causes of neonatal mortality:

- Complications associated with low birth weight / prematurity.
- Birth Asphyxia
- Neonatal infections / sepsis



Essentials elements of newborn care in the context of Ebola

Is all of this possible in an Ebola context?

- Essential newborn resuscitation and care
- Empathy
- Kangaroo care - skin to skin?
- Early enteral nutrition (no feeding with breast milk)
- Treatment of the sick newborn

YES – Essential newborn care can be provided in ETUs
“Ebola survivors – gardes malades” play an important role



Essential newborn care in an ETU

| Essential newborn resuscitation | |
|--|---|
| Newborns in good condition | Sick newborns |
| Thermoregulation; Skin to skin | Essential newborn care |
| Early initiation of enteral nutrition => breast-milk only if proven Ebola-virus negative | Management - structured newborns: A B C D E Importance of respiratory support (e.g. bCPAP Caffeine- Citrate (premature baby) |
| Cord care | Maintenance fluid and enteral nutrition |
| Ophthalmic care | Infections: Identification of risk factors & management |
| Vitamine K1 | Other things to consider - examples: <ul style="list-style-type: none">• Phototherapy• Other |
| Vaccinations: Polio, BCG, Hep B | |
| Specific treatment (MAB114/Regeneron) => Ebola exposed newborn | |
| Prevention of infections examples: Prevention of mother-to-child transmission HIV, malaria, others | |
| Follow up after discharge | |

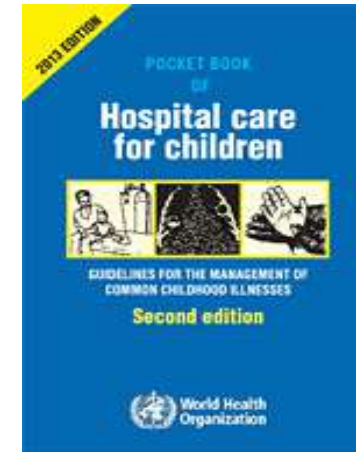


Essential newborn care in Ebola Treatment Units

Same levels of care as health centers and district/regional hospitals



Essential newborn resuscitation is simple – but efficient.
Training & preparation is needed.
In „Ebola context“ - treatment with PPE.



Pregnant women with EVD

Specific scenarios



Follow-up of pregnant women who survived EVD

| Scenario | Follow-up |
|--|--|
| Mother delivered in ETU | No initial breast feeding Mother and child are separated Confirm negative Ebola PCR in breast-milk Newborn => prophylactic Mab114 or Regeneron Ebola- PCR testing |
| Mother survives EVD and leaves ETU before delivery | Delivery needs to take place in ETU setting with full IPC precautions No initial breast feeding Mother and child are initially separated Confirm negative Ebola-PCR in breast-milk Newborn=> Ebola-PCR testing |

Nursery associated with ETUs



- For children whose parents are treated in ETU
- Ebola orphans
- Mothers who survived Ebola + delivered in an ETU



Mariam improved



Mariam had suspected EVD

⇒ But she had two negative tests – with an interval of 48 hours

At presentation:

- Obstructed airways & poor respiratory effort
- Shock & severe anaemia
- Convulsions

Hb: 3,5 g/dl

Blood-sugar: 2,5 mmol/l

MRDT +

Treatment?



Immediate emergency care – ABCDE

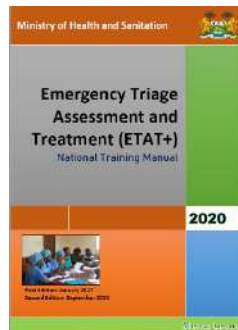
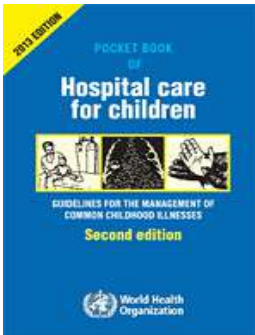
How do we treat Mariam?

Treatment by immunized health workers & PPE => following IPC- recommendations

| | | |
|----------|---|---|
| A | Airway | Clearing airways |
| B | Breathing | Bag-mask ventilation & O2 |
| C | Circulation – including Severe Dehydration & Anaemia | No- pre-transfusion bolus – urgent transfusion |
| D | Disability (Coma and Convulsion) | Correction of hypoglycemia; control of seizures |
| E | Exposure (e.g. skin, abdomen, joints & bones) | Re-evaluation |

Positioning, oro-gastric tube

Artesunate/Ceftriaxone; Maintenance fluids => clinical surveillance



Fluid requirements after initial resuscitation

Maintenance fluids & on-going fluid losses

Maintenance fluids

Isotonic & electrolyte balanced fluids (e.g., Ringer Lactate + Dextrose 5/10%)

Enteral fluids: ORS

After stabilisation - introduce enteral nutrition gradually.

If enteral nutrition or fluids are started reduce IV fluids accordingly.

PLUS

Frequent re-evaluation is needed

Fluid losses

- Diarrhea
- Vomiting

Replace with:

Ringer Lactate +/- Dextrose
ORS

Maintenance fluids - “4-2-1 rule”

| weight | ml/kg/day | ml/kg/hour |
|----------|-----------|------------|
| 0-10kg | 100 | 4 |
| 11- 20kg | 50 | 2 |
| > 20kg | 20 | 1 |

The « 4-2-1 rule » is not more, than an estimation. Reduce maintenance fluids in critically ill patients in certain conditions:

- Respiratory failure + need for O2 and respiratory support
- Coma (e.g., traumatic brain injury, severe cerebral infections)
- Post- transfusions
- Critically ill children with SAM/Kwashiorkor

=> For example 70% of the « 4-2-1- rule » can be administered in these contexts.

See specific sections for: acute kidney injury, diabetic keto-acidosis, heart failure etc.

| weight (kg) | ml/hr | ml/day |
|-------------|-------|--------|
| 4 | 16 | 400 |
| 5 | 20 | 500 |
| 6 | 24 | 600 |
| 7 | 28 | 700 |
| 8 | 32 | 800 |
| 9 | 36 | 900 |
| 10 | 40 | 1000 |
| 12 | 44 | 1100 |
| 14 | 48 | 1200 |
| 16 | 52 | 1300 |
| 18 | 56 | 1400 |
| 20 | 60 | 1500 |
| 22 | 62 | 1550 |
| 24 | 64 | 1600 |
| 26 | 66 | 1650 |

Adults: An afebrile adult requires around 25–30 ml/kg/day of fluid intake (1.5 to 2 litres per day for an average size adult).
For a febrile patients => account for insensible losses: approximately 2.5 ml/kg/day for each degree greater than 37°C.

Maintenance fluids

Maintenance fluids => isotonic & electrolyte balanced + Dextrose

If pre-mixed fluids are not available => manual preparation & IPC measures

Ringer Lactate + Dextrose 5% = 450 ml RL + 50 ml de D50%



0.9% NaCL => only second option

Further electrolytes can be added => in some settings : KCL, MgSO4, Calcium Gluconate

Administration of IV fluids in children

Paediatric giving sets

Paediatric giving sets



Paediatric giving sets need to be used for fluid administration in children => 60 drops/ml

Example:

- 40ml/hour = 40 drops/min
- The equivalent of 2- 3 hours can be put in the reservoir
- After this interval
 - Re- evaluation => Adapt fluids administration + continue

The giving set can also be used for:

- Rapid IV fluid administration
- Administration of certain medication(ex. Phenobarbitone, Phenytoin)

Maintenance fluids

Ringer Lactate – Dextrose 10%

Maintenance fluids => isotonic & electrolyte balanced + Dextrose

In some patients – Ringer-Lactate- Dextrose 10% is not sufficient to prevent hypoglycemia

Ringer Lactate + Dextrose 10% = 400 ml RL + 100 ml de D50%

OUT!
- 100 ml de RL



ADD!
+ 100 ml de D50 %



Or – Preparation of Ringer Lactate –Dextrose 10% using pre-mixed RL-Dex 5%

OUT!
- 50 ml de RL

| DEXTROSE 5% / RINGER LACTATE | | GLUCOSE 5% / RINGER LACTATE | |
|---|--|--|--|
| DINFDERI5FBF5 | | WHO Class: 24.2 | |
| DEXTROSE 5% / RINGER LACTATE, 500ml, flex. bag, PVC free | | STERILE | |
| GLUCOSE 5% / RINGER LACTATE, 500 ml, poche souple, sans PVC | | | |
| Synonym: glucose 5% / ringer lactate | | Synonyme: dextrose 5% / ringer lactate | |

ADD!
+ 50 ml de D50 %





Thanks for your attention!!
Questions please.

Post- discharge mortality & morbidity - examples



- Severe Malaria
- Severe acute malnutrition
- Low birth weight infants
- Patients recovering from Ebola – concerns and needs
 - Nutritional support
 - Psychological support
 - Management of sequelae (e.g. vision, neurological)
 - Persistence of virus in sperm and breast milk

The importance of “clinical networks” =>
Follow-up in communities & peripheral facilities

Summary

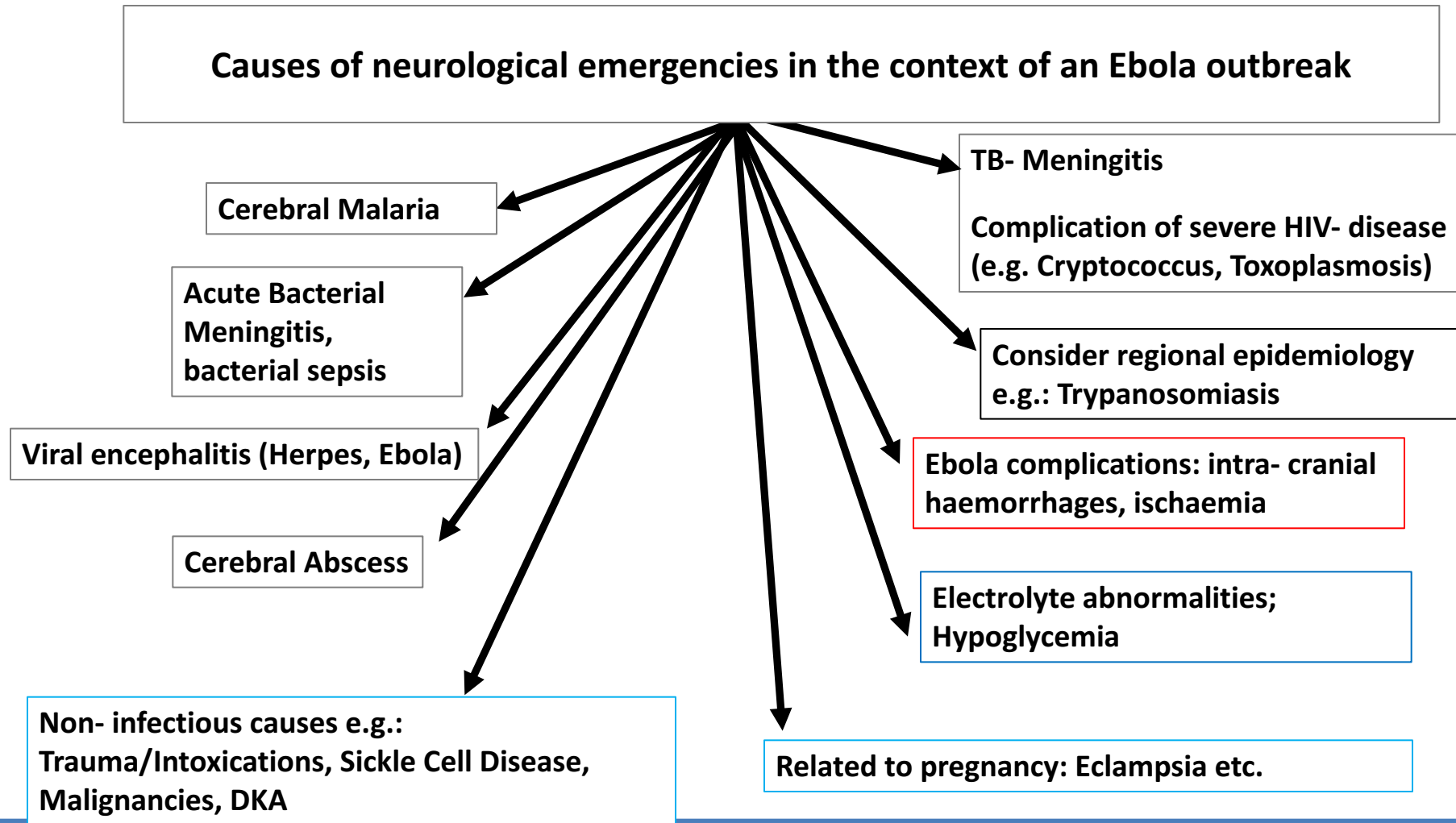


- Early identification of a pregnant patient with suspected EVD.
- Start optimized supportive care as soon as possible.
- Manage complications with usual protocols while maintaining strict PCI measures.
- Good quality neonatal care can be provided in Ebola contexts => “Nurses play an essential role”
- Vaccination and use of specific treatments against Ebola in pregnant women and newborns
- Pregnant and lactating women should receive the prequalified Ervebo (Merck) vaccine (rVSV-ZEBOV-GP, live) during an active Zaire EVD outbreak in affected areas, as part of rigorous research or according to protocol. Compassionate use (informed consent and in accordance with good clinical practice).
- Specific preparation, training and a multidisciplinary approach is necessary.

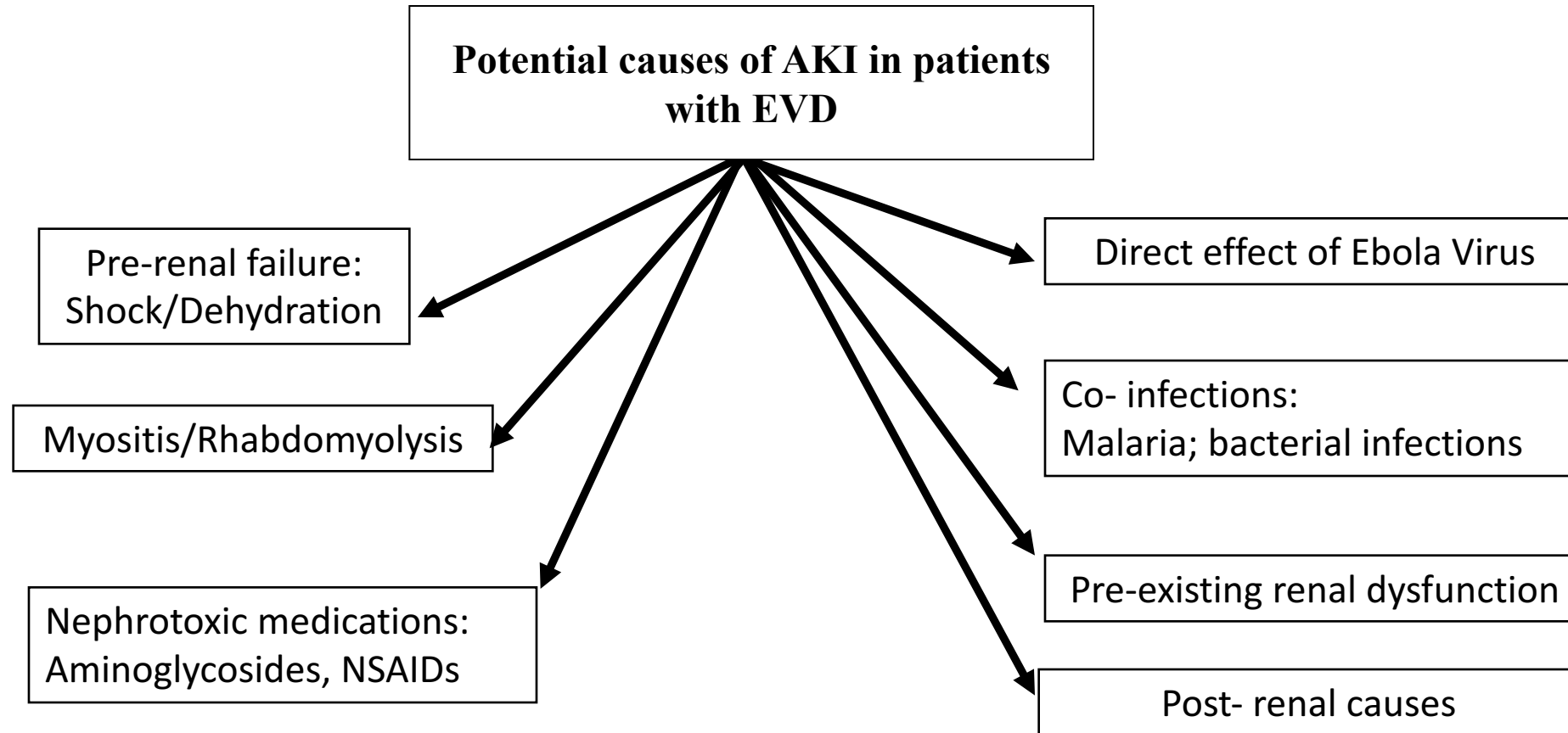


Additional slides

Causes of neurological emergencies in the context of an Ebola outbreak in Malaria endemic regions



Potential causes of AKI in patients with EVD



Acute Kidney Injury (AKI)



Optimized Supportive Care for Ebola Virus Disease

CLINICAL MANAGEMENT STANDARD OPERATING PROCEDURES



- AKI is common among critically patients
- Patients with EVD & AKI => high mortality
- Basic intervention have the potential to improve outcomes of patients with AKI
 - Avoidance of nephrotoxic drugs
 - Management of reversible causes (e.g. shock/dehydration, anaemia)
 - Fluid management
 - Management of electrolyte abnormalities & Acidosis
- RRT to consider in “Level 3 PICUs”

Administration of IV fluids in children and newborns



Large fluid bag –administered to young children

NO!!!!!!



« Les vainqueurs d’Ebola » play an essential role in an Ebola- response



The « gardes malades » are Ebola – survivors =>

Les Vainqueurs d’Ebola

Responsabilities:

- Health care assistants
- Triage and initiation of emergency care
- Psychological support
- Child and neonatal care
- Community based care
- Logistics, WASH etc.



Importance of nutrition of critically ill patients

Structured approach to the introduction of enteral nutrition for critically ill patients/ children +/- malnutrition:

- Importance of safe feeding practices
- Correct equipment needs to be ordered
- Monitoring & documentation
- Training
- Importance of “gardes malades”

=> *See specific session*



Respiratory failure – due to poor respiratory effort

10 March 2021

BCPAP – does not replace bag mask ventilation

