Severe malnutrition

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PMB Metropolitan Hospital Complex Lecture Series

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Lecture adapted from CheRP CD/M Patrick
Is severe malnutrition a problem for the children we care for?

- Mortality
- Morbidity
Deaths by weight in South African hospitals

- Unknown: 32
- Severe malnutrition: 28
- < 3rd centile: 28
- Normal: 32
Types of severe malnutrition

- Kwashiorkor
- Marasmus
- Marasmic Kwashiorkor
Where in the health system do children with severe malnutrition go?

“equal and appropriate access to all levels of care within a district health system”

SA, post 1994
What should you do?

1. Make a diagnosis

3. Assess severity

5. Make a problem list

7. Manage (solve) each problem
# IMCI and Malnutrition

## THEN CHECK FOR MALNUTRITION AND ANAEMIA

### ASK:
- Has the child lost weight?

### LOOK and FEEL:
- **GROWTH**
  - Plot the weight on the RTHC:
    - **Is the child today:**
      - Normal weight
      - Low weight
      - Very low weight
  - Look at the shape of the weight curve:
    - **Does it show:**
      - Weight gain unsatisfactory (That is, flattening curve or weight loss)
      - Gaining weight
  - **Look for visible severe wasting**
  - **Feel for oedema of both feet**
- **ANAEMIA**
  - **Look at palmar palor. Is there:**
    - Severe palmar palor?
    - Some palmar palor?
  - **If any palor, check haemoglobin (Hb) level**

### Classify all for NUTRITIONAL STATUS

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Action</th>
</tr>
</thead>
</table>
| **Very low weight** or **Visible severe wasting** or **Oedema of both feet** | SEVERE MALNUTRITION | Give additional dose Vitamin A (p. 16)  
Test for low blood sugar, then treat or prevent (p. 13)  
Refer URGENTLY  
Keep the child warm |
| **Low weight** or **Weight gain unsatisfactory** | NOT GROWING WELL | Assess feeding & counsel (p. 20)  
If feeding problem, follow-up in 5 days  
Treat for worms if due (p. 16)  
Advise when to return immediately (p. 21)  
Follow Vitamin A schedule (p. 16)  
If close TB contact, manage according to local TB guidelines  
Follow up in 14 days |
| **Not low weight and / or Weight gain satisfactory** | GROWING WELL | If child is less than 2 years, assess and counsel on feeding (p. 17)  
If feeding problem, follow-up in five days  
Treat for worms if due (p. 16)  
Follow Vitamin A schedule (p. 15) |
| **Severe palmar palor or Hb < 6.0 g/dl** | SEVERE ANAEMIA | Refer URGENTLY |
| **Some palmar palor or Hb 6 up to 10.0 g/dl** | ANAEMIA | Give Iron (p. 10) and counsel on iron rich diet (p. 20)  
Assess feeding & counsel (p. 17, 20)  
Treat for worms if due (p. 16)  
Follow-up in 14 days |
| **No palor** | NO ANAEMIA | If child is less than 2 years, assess feeding and counsel (p. 17) |
Make a diagnosis of severe malnutrition

- Use “Welcome” Classification
- Severe malnutrition
  - Kwashiorkor
  - Marasmus
  - Marasmic Kwashiorkor
New Classification of Severe Acute Malnutrition

A new classification system for acute malnutrition

- **Complicated malnutrition**
  - <80% of median weight for height (≤2 SD-score)
  - or bilateral pitting oedema
  - or mid-upper arm circumference <110 mm
  - and one of the following:
    - Anorexia
    - Lower respiratory tract infection
    - High fever
    - Severe dehydration
    - Severe anaemia
    - Not alert

  → **Inpatient stabilisation care**

- **Severe uncomplicated malnutrition**
  - <70% of median weight for height (≤3 SD-score)
  - or bilateral pitting oedema
  - or mid-upper arm circumference <110 mm
  - and:
    - Appetite
    - Clinically well
    - Alert

  → **Outpatient therapeutic care**

- **Moderate uncomplicated malnutrition**
  - 70–80% of median weight for height (≤3 SD-score to ≤2 SD-score)
  - and no oedema
  - or mid-upper arm circumference 110–125 mm
  - and:
    - Appetite
    - Clinically well
    - Alert

  → **Outpatient supplementary feeding**
INTEGRATED MANAGEMENT OF CHILDHOOD ILLNESS

SICK CHILD AGE 2 MONTHS UP TO 5 YEARS

Assess, Classify and Identify Treatment
- General Danger Signs .................................................. 2
- Cough or difficult breathing ........................................... 2
- Wheezing .................................................................... 2
- diarrheaa ................................................................. 2
- Fever .......................................................................... 2
- Pneumonia ................................................................ 2
- Measles ....................................................................... 2
- Malnutrition and Anaemia ............................................. 6
- Malaria ......................................................................... 6
- Immunization Status .................................................... 7
- Other problems ........................................................... 7
- Antimicrobials .............................................................. 8

Drug Therapy
- Amoxicillin ................................................................. 8
- Clarithromycin ............................................................ 8
- Cefadroxil .................................................................. 8
- Enfuvirtide ................................................................. 8
- Ribavirin ..................................................................... 8
- Pentamidine ............................................................... 8
- Pyrimethamine ........................................................... 8

Follow-Up Care
- Temperature .............................................................. 10
- Pain ........................................................................... 10
- Malnutrition ............................................................... 10
- Breastfeeding ............................................................ 10

Treatment for Local Infections
- Ear drops for chronic ear infection .................................. 11
- Mouth Ulcers ............................................................. 11
- Oral thrush .................................................................. 11
- Skin infection (wound) ................................................ 11

TREATMENT IN CHILDREN ONLY
- Oral thrush .................................................................. 12
- Enzymatic substance .................................................. 12
- Diarrhea ....................................................................... 12
- Oral thrush .................................................................. 12
- Low blood sugar protection ........................................ 15
- Low blood sugar treatment ......................................... 15

SICK YOUNG INFANT
AGE 1 WEEK UP TO 2 MONTHS

Assess, Classify and Identify Treatment
- Possible Bacterial Infection ........................................... 17
- Diarrhea ...................................................................... 18
- Malnutrition and Growth in Infants ............................. 18
- Feeding problem and Growth in non-Breasted infants .... 18
- Special Risk Factors .................................................. 18
- Immunization Status .................................................. 18
- Other Problems ........................................................ 18
- Mother’s health ........................................................ 18

Treat the Young Infant and Counsel the Mother
- Oral Antibiotics .......................................................... 20
- Intravenous Antibiotics (IVC) ...................................... 20
- Diarrhea ..................................................................... 20
- Fluid replacement ...................................................... 20
- Rehydration Salts ....................................................... 20
- Local treatment at Home ............................................. 20
- Correct Positioning and Attachment for Breastfeeding .. 20
- Replacement (formula) feeds ..................................... 20
- General home care .................................................... 20
- Pain ............................................................... 20
- Other problems ........................................................ 20
- Measles (optional chart) ............................................. 20

Recording Form: Infant Age 1 week up to 2 months

Guidelines for care at the first-referral level in developing countries.
Assess severity of “severe malnutrition”

Sitting Kwashy
- Signs of Kwash
- No obvious infection
- No weeping skin lesions

Lying Kwashy
- Signs of Kwash
- Any infection
- +/- weeping skin lesions
Investigate according to severity

Sitting kwashy

- CXR
- Tine test
- Urine dipstix
- Rapid blood sugar
- Ward Hb
- HIV ELISA

Lying kwashy

- FBC
- U&E, TP, Alb
- Blood culture
- Urine & CSF if indicated
- Pus swab if skin sepsis
Make a problem list looking for the following:

- Hypoglycaemia
- Hypothermia
- Shock and dehydration
- Electrolyte imbalance
- Infections
- Correct micronutrient deficiencies
- Food intolerance
- Wasting
- Apathy
- Poverty
WHO 10 Steps

1. Correct micronutrient deficiencies
2. Treat/prevent hypoglycaemia
3. Start cautious feeding with start up feeds
4. Treat/prevent hypothermia
5. Rebuild wasted tissues with catch up feeds
6. Treat/prevent dehydration
7. Provide stimulation, play and loving care
8. Correct electrolyte imbalance
9. Treat infections
10. Prepare for follow up after hospital discharge
<table>
<thead>
<tr>
<th></th>
<th>Stabilization</th>
<th>Rehabilitation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Days 1–2</td>
<td>Days 3–7</td>
</tr>
<tr>
<td>1.</td>
<td>Hypoglycaemia</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Hypothermia</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Dehydration</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Electrolytes</td>
<td>---</td>
</tr>
<tr>
<td>5.</td>
<td>Infection</td>
<td>---</td>
</tr>
<tr>
<td>6.</td>
<td>Micronutrients</td>
<td>--- no iron</td>
</tr>
<tr>
<td>7.</td>
<td>Initiate feeding</td>
<td>---</td>
</tr>
<tr>
<td>8.</td>
<td>Catch-up growth</td>
<td>---</td>
</tr>
<tr>
<td>9.</td>
<td>Sensory stimulation</td>
<td>---</td>
</tr>
<tr>
<td>10.</td>
<td>Prepare for follow-up</td>
<td>---</td>
</tr>
</tbody>
</table>
1. Hypoglycemia - Treat

- Check HGT at admission & 3 hourly
- If <2.6
  - Feed (recheck in $\frac{1}{2}$ hr)
  - IVI 10% sol (50% dextrose & sterile water 1:4) 2 - 5ml/kg
Hypoglycemia - Prevent

- 3 hrly feeds
- NGT if refuses feeds
- IVI if unable to take feeds
- More frequent feeds
- Stop HGT monitoring after 24-72 hrs if improving
2. Hypothermia

- Keep warm
- Measure temperature 4 hrly
- <36 degrees Celsius
  - Warm blanket
  - Heater
  - Away from window!
3. Shock and dehydration

- If shocked, give volume expander

- If dehydrated, give ORS or IV $\frac{1}{2}$ DD
Chart 8. How to give IV fluids for shock in a child with severe malnutrition

Give this treatment only if the child has signs of shock and is lethargic or has lost consciousness:

- Insert an IV line (and draw blood for emergency laboratory investigations)
- Weigh the child (or estimate the weight) to calculate the volume of fluid to be given
- Give IV fluid 15 ml/kg over 1 hour. Use one of the following solutions (in order of preference):
  - Ringer’s lactate with 5% glucose (dextrose); or
  - half-normal saline with 5% glucose (dextrose); or
  - half-strength Darrow’s solution with 5% glucose (dextrose); or, if these are unavailable,
    - Ringer’s lactate.

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Volume IV fluid</th>
<th>Weight (kg)</th>
<th>Volume IV fluid</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>60 ml</td>
<td>12</td>
<td>180 ml</td>
</tr>
<tr>
<td>6</td>
<td>90 ml</td>
<td>14</td>
<td>210 ml</td>
</tr>
<tr>
<td>8</td>
<td>120 ml</td>
<td>16</td>
<td>240 ml</td>
</tr>
<tr>
<td>10</td>
<td>150 ml</td>
<td>18</td>
<td>270 ml</td>
</tr>
</tbody>
</table>

- Measure the pulse and breathing rate at the start and every 5–10 minutes.

If there are signs of improvement (pulse and breathing rates fall):
- give repeat IV 15 ml/kg over 1 hour; then
- switch to oral or nasogastric rehydration with ReScMal (see page 83), 10 ml/kg/h up to 10 hours;
- initiate refeeding with starter F-75 (see page 85).

If the child fails to improve after the first 15 ml/kg IV, assume the child has septic shock:
- give maintenance IV fluid (4 ml/kg/h) while waiting for blood;
- when blood is available, transfuse fresh whole blood at 10 ml/kg slowly over 3 hours (use packed cells if in cardiac failure); then
- initiate refeeding with starter F-75 (see page 85).

If the child deteriorates during the IV rehydration (breathing increases by 5 breaths/min or pulse by 25 beats/min), stop the infusion because IV fluid can worsen the child’s condition.
4. Correct electrolyte imbalance

• **Give extra**
  - Potassium (3-4 mmol/kg/day)
  - Magnesium (0.4-0.6 mmol/kg/day)
5. Infection

- Lying Kwash
  - Ampicillin IVI
  - Gentamicin
    - 5-7 days
  - Plus antihelminthics

- Sitting Kwash
  - Amoxicillin PO
    - 5-7 days
  - Plus antihelminthics

Check that measles vaccine has been given. If not, give immediately unless critically ill
6. Micronutrient deficiency

All children with severe malnutrition have micronutrient deficiencies

- Trace elements
  - Zn & Cu
- Vitamin A
- Multivitamins
- Haematinics
  - Folate stat
  - Iron once gaining weight
7 & 8. Intake: Feeds/Fluids and catch-up growth

- Maintenance PO or NGT
- Usual volume for age
- Type
  - Breast feeding/formula <1yr of age
  - Formula/artificial feed >1yr of age (Pediasure is nice)
  - Full ward diet ASAP (do not forget to give FOOD)
- IVI - 2/3 maintenance if unable to tolerate oral feeds
9. Sensory stimulation

• In the recovery phase the child needs:
  - Love
  - Play
  - Mothering (fathering)
10. Prepare for going home

- Enable access to social grants
  - Child support grant
  - Foster care grant
  - Care dependency grant (for children who are CARE DEPENDENT)
- Refer to local Integrated Nutrition Programme
- Check for missed vaccinations, and bring up to date
When to go home?

• 4-6 weeks
• No edema
• Gaining weight
• Cheerful & interactive
Some special issues..

• Marrow failure
  - Anaemia
  - Thrombocytopenia
  - Leucopenia

• Cardiac failure

• Unexpected death

• Tuberculosis

And HIV!
Always do an x-ray in a child with malnutrition, looking for TB

Do a mantoux on admission, and a month later
Are you now able to look after this little person?...
Management of children with severe malnutrition

Department of Paediatrics and Child Health
University of KwaZulu-Natal
Metropolitan Department of Paediatrics

Major Global Causes of 10.9 Million Deaths among Children under Five Years 2000

- Pneumonia 20%
- Diarrhoea 12%
- Malaria 8%
- Measles 5%
- HIV/AIDS 4%
- Perinatal 22%
- Other 29%
Severe malnutrition represents an important cause of death in poor countries

% deaths attributable to severe malnutrition (MUAC < 110 mm)

<table>
<thead>
<tr>
<th>Country</th>
<th>% Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>24.9</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>19.1</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>33.1</td>
</tr>
<tr>
<td>N Malawi</td>
<td>6.7</td>
</tr>
<tr>
<td>SW Uganda</td>
<td>16.7</td>
</tr>
<tr>
<td>Senegal</td>
<td>10.2</td>
</tr>
</tbody>
</table>

Adapted from Pelletier et al, J Nutr. 1994.
Why is the therapeutic management of severe malnutrition not visible in the international health agenda?

How many child deaths can we prevent this year?

Scientific paradigms and childhood malnutrition

- Protein paradigm 1930-1970
- Energy paradigm 1970
- Hospital as sole place for case-management 1970-2005
- Free radical paradigm 1987
- Micronutrient paradigm 1990
- Community Based case-management 1991
- Ready to Use Therapeutic Food 2000
- MUAC as universal screening instrument 2005

Nutrition is the Cinderella in the sciences, and nutritionists are usually individualistic, jacks of all trade which makes unequivocal guidance of other/health professionals difficult.

Medical textbooks often lag decades behind in clinical nutritional scientific information regarding malnutrition in children. As a result fieldworkers trained with WHO manuals are up to date, doctors not!

Clinical nutritional disease are hard(ly) to recognise(d) for the general physician in district health systems, and treatment of such patients is often relegated to nurses or dieticians.
Understanding and case-management of (oedematous-) wasting disease in children

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>Slow therapeutic reversal of reductive adaptation reduced in hospital sudden death</td>
</tr>
<tr>
<td>1970</td>
<td>Energy cost of growth: good catch-up from wasting reduces mortality, relapse and subsequent morbidity</td>
</tr>
<tr>
<td>1990</td>
<td>Free radical - Multi Organ failure approach led to single digit case-fatality rates for oedematous malnourished children</td>
</tr>
<tr>
<td>2000</td>
<td>Dissemination through WHO of this evidence in management protocols</td>
</tr>
<tr>
<td>2006</td>
<td>YET despite these evidence based protocols, medical doctors often fail to apply them: WHY?</td>
</tr>
</tbody>
</table>
Evidence based protocols WHO present this new case management
Practices of medical doctors are hard to change: could we leave them out in the case management of malnourished children?


<table>
<thead>
<tr>
<th></th>
<th>District Hospital trained WHO manuals (pre/post)</th>
<th>2000</th>
<th>2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctors error</td>
<td></td>
<td>39%</td>
<td>78%*</td>
</tr>
<tr>
<td>Nursing staff error</td>
<td></td>
<td>33%</td>
<td>6%</td>
</tr>
<tr>
<td>Systems fault</td>
<td></td>
<td>0%</td>
<td>1%</td>
</tr>
<tr>
<td>Unavoidable</td>
<td></td>
<td>28%</td>
<td>11%</td>
</tr>
</tbody>
</table>

* Medical staff replaced before post test!!
Even with present knowledge and means, mortality in tertiary units in sub Sahara Africa remains 15-25%
HIV has changed the patterns of malnutrition

- Less kwashiorkor but more children with marasmus
- Older children
  - uncertain how to screen and manage
- Recurring admissions and responses
- Altered caregiving
- Responses to ART are confusing
A team approach is essential
Defining severe malnutrition

- **Commonest**
  - Weight for age <60% expected median NCHS ref values
  - Confounded by low stature

- **Better**
  - Weight-for-height <70% or < -3SD of the median NCHS reference values
  - But height and length rarely measured

- **Useful**
  - MUAC <110mm
  - Visible signs of severe wasting
  - Bilateral pitting oedema
Coloured MUAC tape

- No numbers
  - Suitable for use by uneducated people
- Facilitates work of community-based case-finders
Appropriate detection by using MUAC < 110 mm 6-60 months
## Wellcome classification

<table>
<thead>
<tr>
<th>Weight (% of standard)</th>
<th>Oedema</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 – 60</td>
<td>Present Kwashiorkor Absent Underweight</td>
</tr>
<tr>
<td>&lt;60</td>
<td>Present Marasmic kwash Absent Marasmus</td>
</tr>
</tbody>
</table>
# Waterlow classification

<table>
<thead>
<tr>
<th>Category</th>
<th>Height for age</th>
<th>Weight for height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>$\geq 90%$ standard</td>
<td>$\geq 80%$ standard</td>
</tr>
<tr>
<td>Stunted</td>
<td>$&lt;90%$ standard</td>
<td>$\geq 80%$ standard</td>
</tr>
<tr>
<td>Wasted</td>
<td>$\geq 90%$ standard</td>
<td>$&lt;80%$ standard</td>
</tr>
<tr>
<td>Wasted and stunted</td>
<td>$&lt;90%$ standard</td>
<td>$&lt;80%$ standard</td>
</tr>
</tbody>
</table>
Conceptual differences between clinical paediatric resuscitation and nutritional rehabilitation of severely malnourished children:

**Clinical paediatric resuscitation of well-nourished children:**
- Aims at correcting life-threatening conditions
- Restoring vital functions
- Correction plasma levels and volume
- Treating septicaemia

**Clinical nutritional rehabilitation:**
- Resuscitation/rehabilitation = survival is reversing a process of reductive adaptation
- Restoration of cellular function precedes replenishment of bodystores, equilibration of plasmavolumes and its composition, and ultimately correction of bodycomposition
Metabolic changes while reversing reductive adaptation: hard practice for APLS trained physicians

<table>
<thead>
<tr>
<th>Physiological change</th>
<th>Malnourished (M)</th>
<th>Recovered (R)</th>
<th>( \frac{M-R}{R} ) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metabolic rate, kJ/kg(^{0.75})/day</td>
<td>315</td>
<td>417</td>
<td>-24</td>
</tr>
<tr>
<td>Sodium pump activity, turnover of pool per hour</td>
<td>3.62</td>
<td>4.94</td>
<td>-27</td>
</tr>
<tr>
<td>Intracellular sodium, mmol/kg DS(^a)</td>
<td>169</td>
<td>109</td>
<td>+55</td>
</tr>
<tr>
<td>Intracellular potassium, mmol/kg DS(^a)</td>
<td>341</td>
<td>387</td>
<td>-12</td>
</tr>
<tr>
<td>Protein synthesis, g/kg/day</td>
<td>4.0</td>
<td>6.3</td>
<td>-37</td>
</tr>
<tr>
<td>Protein breakdown, g/kg/day</td>
<td>3.7</td>
<td>6.4</td>
<td>-37</td>
</tr>
<tr>
<td>Cardiac output, l/min/m(^3)</td>
<td>4.77</td>
<td>6.90</td>
<td>-31</td>
</tr>
<tr>
<td>Stroke volume, ml/beat/m(^3)</td>
<td>44.1</td>
<td>53.0</td>
<td>-22</td>
</tr>
<tr>
<td>Circulation time, seconds</td>
<td>13.7</td>
<td>10.5</td>
<td>+30</td>
</tr>
<tr>
<td>Glomerular filtration rate, ml/min/m(^3)</td>
<td>47.1</td>
<td>92.4</td>
<td>-41</td>
</tr>
<tr>
<td>Renal blood flow, ml/min/m(^3)</td>
<td>249</td>
<td>321</td>
<td>-22</td>
</tr>
<tr>
<td>( \text{H}^+ ) excretion after NH(_4)Cl, ( \mu \text{equiv/min} )</td>
<td>10.4</td>
<td>28.4</td>
<td>-63</td>
</tr>
<tr>
<td>Osmolal clearance rate, ml/min</td>
<td>0.20</td>
<td>0.66</td>
<td>-70</td>
</tr>
<tr>
<td>Sodium excreted, % of infused</td>
<td>22.3</td>
<td>48.7</td>
<td>-54</td>
</tr>
<tr>
<td>Sodium excreted, % of sodium filtered normal ECF</td>
<td>0.50</td>
<td>1.23</td>
<td>-59</td>
</tr>
<tr>
<td>expanded ECF</td>
<td>0.82</td>
<td>11.07</td>
<td>-93</td>
</tr>
<tr>
<td>Response to temperature change</td>
<td>poikilotherm</td>
<td>homoeotherm</td>
<td></td>
</tr>
</tbody>
</table>
Why oedema?
The problem with albumin

- Low albumin found in both children with other poor prognostic signs and those without poor prognostic signs

- Clinical improvement occurs without improved protein levels

- Deterioration occurs even when protein levels improve

- Protein levels improve over weeks
Why oedema?

- **Free radical hypothesis**
  - Repeated infections deplete body’s antioxidant systems
  - Free radicals produced normally by body to attack infections start to damage own cells
  - Cell membranes become ‘sick’ and normal Na:K pump becomes deranged
  - Na gets stored in cells, in excess
  - K gets thrown out and then lost from the body
  - Result. Body primed to retain Na and .... water
  - Susceptible to water overload and heart failure (wasted heart)
Ten steps for managing children with severe malnutrition
Step 1 - Treat/Prevent Hypoglycaemia

- Hypoglycaemia and hypothermia often go together
- If <3mmol/l
  - Give 5ml/kg 10% dextrose
  - Antibiotics
  - Feed every 2 hours day and night
- If temperature falls <35.5°C repeat dextrostix
- If level of consciousness drops repeat dextrostix
Step 2. - Treat/Prevent Hypothermia

- If axillary temp < 35°C, check rectal temp. If rectal temp < 35.5°C,
  - Feed straightaway (and/or rehydrate)
  - Rewarm +/- heater
  - Antibiotics

- Monitor:
  - Temp / 2 hours until rectal temp >36°C
  - Ensure covered at all times, esp at night. Feel for warmth
  - Check for hypoglycaemia

- Prevention
Step 3. - Treat/Prevent Dehydration

- Low blood volume can occur with oedema
- Avoid IVs except in shock. Infuse slowly
- Give special low Na Rehydration Solution for Malnutrition (ReSoMal) 5-10ml/kg/hr
- Follow with feeds (F75) at 6-10 hours
- Monitor signs during rehydration
  - Heart rate
  - Respiratory rate
  - Hepar
  - Urine frequency and vomiting
- Prevent
  - Feed with starter F75
  - Replace stool volume losses with ReSoMal
  - Encourage BF if able
Appendix 1: Recipes for ReSoMal & electrolyte mineral solution

Recipe for ReSoMal oral rehydration solution

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water (boiled &amp; cooled)</td>
<td>2 litres</td>
</tr>
<tr>
<td>WHO-ORS</td>
<td>One 1 litre-packet*</td>
</tr>
<tr>
<td>Sugar</td>
<td>50g</td>
</tr>
<tr>
<td>Electrolyte/mineral solution (see below)</td>
<td>40ml</td>
</tr>
</tbody>
</table>

ReSoMal contains approximately 45mmol Na, 40mmol K and 3mmol Mg/litre.

*3.5g sodium chloride, 2.9g trisodium citrate dihydrate, 1.5g potassium chloride, 20g glucose.
Step 4. – Correct Electrolyte Imbalance

• Severely malnourished children are Na overloaded
  - Excess Na kills
  - Also deficient in K⁺ and Mg²⁻
• May take 2 weeks to resolve
• Give
  - Extra potassium
  - Extra Magnesium
  - Use low Na ORS
  - Prepare food without salt
Step 5. - Treat/Prevent Infection

- In malnourished children usual signs of infection are often absent
- Treat all malnourished children with antibiotics
  - Cefuroxime and Gentamycin
  - Amoxycillin and Gentamycin
- If the child fails to get better, add Chloramphenicol
- If anorexia does not improve in 5 days then continue treatment until 10 days
- If still not improving, reassess for other sites of infection
Step 6. – Correct Micronutrient Deficiencies

- All malnourished children will have micronutrient deficiencies
- Though anaemia is common, do not give iron until weight is recovering and avoid transfusion unless Hb < 5gm/dL or if symptomatic < 7gm/dL (never transfuse after 24-48 hours)
- Give Vitamin A on D1 and D2
- Give MVS / Folic acid / Zinc / Copper for at least 2 weeks. Add iron when weight is improving
Step 7. - Start Cautious Feeding

• Stabilisation phase
  - Small frequent feeds, low osmolarity, low lactose
  - Oral or NG (never parenteral)
  - 100cal/kg/d
  - 1-1.5gm protein/kg/d
  - 130ml/kg/d (100ml/kg/d if severely oedematous)
  - Continue BF if possible

• If oral intake does not exceed 80cal/kg/d change to NG feeding
Step 8. - Achieve Catch-up Growth

- Rehabilitation phase
- To achieve high intakes and rapid weight gain (<10g gain/kg/d)
- F100 or porridges with similar energy content
- Monitor for heart failure
- After transition give:
  - Frequent feeds (at least 4 hourly)
  - 150-200+cal/kg/d
  - 4-6 g protein /kg/d
- CT BF
Ready to Use Therapeutic Food (RUTF)

• Oil based paste nutritionally equivalent to WHO F100
• Very low water content (activity) so resists bacterial contamination
  - Lasts for 3-6 months at home unrefrigerated
• Local production easy & cheaper
  - Using local crops
Step 9. - Provide Sensory Stimulation and Emotional Support

- TLC
- A cheerful stimulating environment
- Structured play therapy
- Physical activity as soon as able
- Maternal involvement where possible
Step 10.- Prepare for Follow-up after Recovery

- At 90% wt/ht = recovery and ready for discharge
- Good feeding practices - food and methods
- Structured play therapy
- Regular follow-up
- Ensure immunisations are up to date
- Make sure 6 monthly vitamin A is given