

ENTERAL AND PARENTERAL NUTRITIONAL CARE

Statement of Best Practice

- Feeding with mother's own breastmilk is protective against sepsis, NEC and death.
- All mothers should be informed about this and strongly encouraged to express their own milk in the first 24 hours of the baby's life (or before birth) irrespective of their milk feeding preferences.

Simplified Nutritional Strategy

- Patients with a bowel rest of >5 days for any medical/surgical condition might require a modification to the simplified nutritional strategy. Please refer to separate guideline (Special Considerations for Nutritional Care of Patients with Stoma).
- The simplified nutritional strategy will depend on birth or current weight. Babies will change risk group/strategy as they grow according to the list below:
 - High risk: < 1.2 kg
 - Moderate risk: $\geq 1.2 - \leq 1.5$ kg
 - Low risk: > 1.5 kg

General Nutritional Considerations for Parenteral and Enteral Nutrition

- For a detailed specification of the composition of the different parenteral nutrition solutions please refer to the EXCEL TPN prescription form.
- Aim for a total of 120 kcal/kg/day (20 - 25 kcal of non-protein calories per 1 g of protein intake) once on steady state intake.
- Aim for ≤ 10 mg/kg/min glucose intake, 3.5 g/kg/day of protein intake (max. 4 g/kg/day) and 3.5 g/kg/d (max. 4 g/kg/d) of lipid intake.
- Aim for linear growth from 28 weeks onwards at >17 g/kg/d per day up to 2 kg weight and then 30 g per day over a 7 day period.
- Aim to keep growth (weight, length and head circumference) between birth centile and centile at 3 weeks of life

Special Considerations for Total/Partial Parenteral Nutrition (PN)

- There are 2 concentrated Parenteral Nutrition (aqueous) and 1 Lipid options:
 - SCAMP EF-TPN = electrolyte-free concentrated PN
 - SCAMP TPN = concentrated PN with electrolytes and trace elements
 - Lipid = SMOF lipids with vitamins
- All Parenteral Nutrition (incl. Lipids) can be used up to a maximum of 48 h
- There is no need to build up PN volume. The maximum volume of PN (including lipids) should equate to the total daily available fluid volume after exclusion of other infusions and feeds.
- **Do not exceed 96 ml/kg/day Concentrated PN or 24 ml/kg/day Lipid (SMOF) or a total of 120 ml/kg/day TPN.**
- If more than 120 ml/kg/day of IV fluids are required after exclusion of other infusions and feeds, add a sidearm of Glucose 5% to make up the remainder of the fluids to the required total IV volume (see chart below). A plain Glucose 5% sidearm can be changed every 48 h together with the rest of the TPN.
- Provide additional electrolytes in sidearm as needed. Calcium can only be given centrally except in emergencies. A Glucose sidearm to which electrolytes have been added on the unit needs to be changed every 24 h.
- The ratio of Concentrated PN and Lipid (SMOF) should remain at all times at:
4 (PN):1 (Lipid)

Monitoring

- Anthropometry - measure weight on alternate days, head circumference and length weekly
- Daily – nutritional intake (fluid, protein, fat, carbohydrates, electrolytes, energy), blood glucose, triglycerides, urine analysis and blood pressure measurement until on a constant PN volume.
- Weekly – nutritional intake, blood glucose, triglycerides (once PN not increasing), liver function.
- Lipid intake needs to be reduced irrespective of protein and carbohydrate intake, if triglyceride levels exceed 3.5 mmol/l – please indicate on the prescription sheet.
- Monthly – trace minerals (copper, zinc, selenium).

Establishing TPN Infusion Rate

1. Total IV Fluid volume in ml/kg/day = Total Fluid requirements in ml/kg/day – Oral fluid intake in ml/kg/day
2. Total PN volume in ml/kg/day = Total IV Fluid volume in ml/kg/day – Other IV Infusions in ml/kg/day
3. Lipid volume in ml/kg/day = Total PN volume in ml/kg/day (**max. 120 ml/kg/day**) divided by 5
4. PN volume (aqueous solution) in ml/kg/day = Total PN volume in ml/kg/day - Lipid volume in ml/kg/day
5. Give rest of IV fluids as Glucose 5% Sidearm
6. To calculate the rate in ml/h divide the total daily PN or Lipid volume in ml/kg/day by 24 h and multiply by the weight

Total IV Fluid (ml/kg/day)	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165
Glucose 5% OR NaCl 0.45% Sidearm	No need for Glucose 5% OR NaCl 0.45% Sidearm										If Total IV Fluid requirements > 105 ml/kg/day, start Glucose 5% OR NaCl 0.45% Sidearm to meet Total IV Fluid requirements If tolerated, can increase Total PN to 120 ml/kg/day (max.) before starting Glucose 5% OR NaCl 0.45% Sidearm											
Total PN (ml/kg/day)	60	65	70	75	80	85	90	95	100	105	110	115	120	= 105 – 120 ml/kg/day as tolerated								
PN Bag (ml/kg/day)	48	52	56	60	64	68	72	76	80	84	88	92	96	= 84 – 96 ml/kg/day as tolerated								
Infusion rate (ml/kg/h)	2.0	2.2	2.3	2.5	2.7	2.8	3.0	3.2	3.3	3.5	3.7	3.8	4.0	Multiply by weight to obtain rate for Metavision prescription								
Amino acid (g/kg/day)	2.1	2.2	2.4	2.6	2.7	2.9	3.1	3.2	3.4	3.6	3.8	3.9	4.1	= 3.6 – 4.1 g/kg/day as tolerated								
Carbohydrate (g/kg/day)	5.8	6.2	6.7	7.2	7.7	8.2	8.6	9.1	9.6	10.1	10.6	11	11.5	= 10.1 – 11.5 g/kg/day plus Glucose 5% Sidearm depending on Total IV Fluid requirements								
Lipid Bag (ml/kg/day)	12	13	14	15	16	17	18	19	20	21	22	23	24	= 21 – 24 ml/kg/day as tolerated								
Infusion rate (ml/kg/h)	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.9	0.9	1.0	1.0	Multiply by weight to obtain rate for Metavision prescription								
Lipid (g/kg/day)	2.1	2.2	2.4	2.6	2.7	2.9	3.1	3.2	3.4	3.6	3.8	3.9	4.1	= 3.6 – 4.1 g/kg/day as tolerated								

Special Considerations for Enteral Nutrition

- Ensure gastric tube is correctly placed at all times (see Guideline for the Use of Oro-Nasogastric tubes)
- Always use colostrum first (whether fresh or frozen) if available
- Use fresh breast milk rather than frozen milk, but only after the stored milk from the first 2 - 3 weeks of life has been used in order of expressing
- Never mix formula and breast milk in one bottle
- Gastric aspirates equivalent to $< 1 - 2$ ml/kg/h (even if slightly bile stained) are acceptable to progress with feeding.
- If in babies ≤ 1.5 kg EBM is not available, use DEBM and if no DEBM available, insert a peripheral cannula and give Dextrose 10% until either EBM/DEBM is available or introduction of or transition to formula has been completed in line with the schedule outlined below.

Supplementing Enteral Nutrition

- Start iron and vitamin supplementation in preterm infants ($< 35 + 0$ weeks or < 2 kg) when > 60 ml/kg/day enteral feeds tolerated irrespective of type of milk or combination with PN. Do not stop iron for blood transfusions.
- Change prescription timings of iron and vitamin supplementation to 10:00 (iron) and 14:00 (vitamins and folic acid) when in Nursery 3.
- Daily vitamin and iron intake:

Milk Type	Abidec/Dalivit	Folic Acid	Sytron
Unfortified Breastmilk	0.6 ml	50 microgram (preterm infants)	0.9 ml/kg
Breastmilk + Fortifier	0.3 ml	Nil	
Preterm Formula	0.3 ml	Nil	
Term Formula & Specialist Formula	0.6 ml	Nil	

- Minimum EBM volume (ideally higher for formula or fortified milk) requirements for oral supplements - split up doses, if necessary:

Additive	Dosage	Minimum EBM per feed per dose
Sytron	0.1 ml	1.2 ml
Folic Acid	50 microgram	1.1 ml
Abidec/Dalivit	0.3 ml	3.0 ml
Sodium Dihydrogen Phosphate	0.1 mmol	1.6 ml
Sodium Chloride	0.1 mmol	0.7 ml
Caffeine Citrate	1 mg	0.5 ml
Chloral Hydrate	1 mg	0.3 ml

Establishing Demand Breastfeeding/Bottle Feeding

- Try to move to 3 hourly feeds by gravity once $> 32 + 0$ weeks' gestation and > 1.5 kg weight, if no medical concerns or on low-flow oxygen.
- For patients weaning off NGT/OGT feeds onto oral feeds refer to Establishing Breastfeeding Guideline
- When establishing breastfeeding top up feeds should be prepared as full feeds according to the Fortification Scheme below

Preparing for Discharge

- Consider discharge at > 1.6 kg and $> 34 + 0$ weeks gestation, if no medical or social concerns
- Patients on SMA Gold Prem 1 should change over to Nutriprem 2 at 2 kg (current weight) or ideally one week before discharge or earlier if weight gain is excessive or oedema is present
- Patients should not be discharged on Fortifier. They should be weaned off ideally one week before discharge or earlier when weight gain is excessive or oedema is present.
- Change daily vitamin supplement to 0.3 ml and iron supplement to 1 ml p.o. per day before discharge. Stop folic acid.
- Babies born $> 34 + 6$ should be started on oral Vitamin D or Dalivit/Abidec supplements if fully breastfed or on exclusive EBM or less than 500 ml per day formula intake
- Involve Health Visitor or Neonatal Outreach Team, if feeding concerns present or enhanced care needed at discharge; refer to Community Paediatric Team, if medical problems including oxygen requirement present at discharge.

HIGH RISK < 1.2 KG

Admission	<ul style="list-style-type: none"> • Insert central venous line (longline or UVC) • Prescribe EF-TPN at 60-90 ml/kg/day as required • Start maternal EBM at 0.5-1 ml if available 2 hourly via Fr 5 NGT/OGT • Receive consent for DEBM
First 24-48h	<ul style="list-style-type: none"> • Give EF-TPN at 90-120 ml/kg/day as required • Increase enteral feeds to 1-2 ml 2 hourly as tolerated • Start DEBM at same volume if MEBM not available/insufficient
Day 3 (>48h)	<ul style="list-style-type: none"> • Prescribe TPN at 120 ml/kg/day with or without Glucose 5% sidearm • Do not increase enteral feeds if not opened bowels, prescribe glycerine spp. • Increase enteral feeds 1 ml 24 hourly if opened bowels once daily • Increase enteral feeds 1 ml 12 hourly if opened bowels > 1 per day
Day 4 and above	<ul style="list-style-type: none"> • Prescribe combination feeding with TPN and enteral feeds aiming for max. 165 ml/kg/day total fluid intake (building up gradually) • Adjust ratio of parenteral and enteral feeds according to total fluid intake and tolerated enteral volume and growth: <ul style="list-style-type: none"> ○ At 130 ml/kg/day give at least 85 ml/kg/day TPN and no more than 45 ml/kg/day EBM ○ At 150 ml/kg/day give at least 70 ml/kg/day TPN and no more than 80 ml/kg/day EBM ○ At 165 ml/kg/day give at least 60 ml/kg/day TPN and no more than 105 ml/kg/day EBM ○ A lower proportion of donor breast milk might be required to achieve good growth in combination with TPN without exceeding total fluid intake • Do not fortify MEBM/DEBM whilst on combination feeding • Give 2 hourly feeds via a Fr 5 OGT/NGT, avoid bigger size gastric tubes • Consider bowel washout if bowels not opened after > 5 days despite glycerine spp. • Increase enteral feeds 1ml 24 hourly if opened bowels once daily and still meconium • Increase enteral feeds 1ml 12 hourly if opened bowels > 1 per day and still meconium • Increase 1ml 8 hourly if opened bowels once daily and yellow stools • Increase 1ml 6 hourly if opened bowels > 1 per day and yellow stools
Weaning PN	<ul style="list-style-type: none"> • Do not wean PN until the patient has reached a weight of approx. 1.2 kg. • Once a weight of approx. 1.2 kg reached continue increasing enteral feeds as long as tolerated until reaching full enteral feeds of max. 165 ml/kg/day. • Follow guidance for WEANING TPN and ESTABLISHING GROWTH WITH ENTERAL NUTRITION in MODERATE RISK GROUP

MODERATE RISK $\geq 1.2 - \leq 1.5$ KG

Admission	<ul style="list-style-type: none"> • Insert central venous line (preferably longline), do not give PN peripherally • Prescribe EF-PN at 60-90 ml/kg/day as required • Start maternal EBM at 1-2 ml if available 2 hourly via Fr 5 NGT/OGT • Receive consent for DEBM
First 24-48h	<ul style="list-style-type: none"> • Give EF-PN at 90-120 ml/kg/day as required • Increase enteral feeds to 2 ml 2 hourly as tolerated • Start DEBM at same volume if maternal EBM not available/insufficient
Day 3 (>48h)	<ul style="list-style-type: none"> • Prescribe TPN at 120 ml/kg/day with or without Glucose 5% sidearm • Do not increase enteral feeds if not opened bowels, prescribe glycerine spp. • Increase enteral feeds 1ml 24 hourly if opened bowels once daily • Increase enteral feeds 1ml 12 hourly if opened bowels >1 per day
Day 4 and above	<ul style="list-style-type: none"> • Prescribe combination feeding with TPN and enteral feeds aiming for max. 165 ml/kg/day total fluid intake (building up gradually) • If enteral feeds tolerated, continue increasing enteral feeds as long as tolerated until reaching full enteral feeds of max. 165 ml/kg/day • If enteral feeds not tolerated, adjust ratio of parenteral and enteral feeds according to total fluid intake and tolerated enteral volume and growth: <ul style="list-style-type: none"> ○ At 130 ml/kg/day give at least 85 ml/kg/day TPN and no more than 45 ml/kg/day EBM ○ At 150 ml/kg/day give at least 70 ml/kg/day TPN and no more than 80 ml/kg/day EBM ○ At 165 ml/kg/day give at least 60 ml/kg/day TPN and no more than 105 ml/kg/day EBM ○ A lower proportion of donor breast milk might be required to achieve good growth in combination with TPN without exceeding total fluid intake • Do not fortify MEBM/DEBM whilst on combination feeding • Give feeds via a Fr 5 OGT/NGT, avoid bigger size gastric tubes • Consider bowel washout if bowels not opened after > 5 days despite glycerine spp. • Increase enteral feeds 1ml 24 hourly if opened bowels once daily and still meconium • Increase enteral feeds 1ml 12 hourly if opened bowels > 1 per day and still meconium • Increase 1ml 8hourly if opened bowels once daily and yellow stools • Increase 1ml 6hourly if opened bowels > 1 per day and yellow stools
Weaning PN	<ul style="list-style-type: none"> • Once enteral feeds of 120 ml/kg/day tolerated, remove central line and stop TPN.
Establishing growth with enteral nutrition	<ul style="list-style-type: none"> • If not tolerating full feeds suggesting reflux, try in descending order: <ol style="list-style-type: none"> 1. Prone/lateral positioning, ensure 30° mattress tilt 2. 2 hourly feeding with Fr 5 OGT/NGT and holding the syringe with its flange at the height of the junction between the lid and the door of a closed incubator or at the upper margin of the plastic sides of an open incubator or cot. This equates to approx. 12 cm above the baby's head and 10 – 20 min feed. 3. 1 hourly gravity feeding 4. 2 hourly feeding by pump starting at 60 minutes and increasing by 30 minutes to max. 1 h 30 minutes; wean 5 - 10 minutes every day as soon as feeding tolerance established until tolerating 40 minute pump feeds 5. Try 2 hourly gravity feeds or, if not tolerated, 1 hourly gravity feeding again • Continue with full feeds for approx. 1 week and review tolerance and growth • If enough MEBM available but not growing, then fortify MEBM with SMA fortifier according to Scheme below before introducing formula • If not enough MEBM available and on DEBM, then, once 120 ml/kg/day tolerated, introduce one formula feed of SMA GP 1 at same volume according to the Scheme below until all DEBM feeds are replaced completely • If not enough MEBM available and on combination with formula and not growing, fortify MEBM with SMA fortifier according to Scheme below before increasing the number of formula feeds

LOW RISK > 1.5 KG

Admission	<ul style="list-style-type: none"> • Insert peripheral venous access
------------------	---

	<ul style="list-style-type: none"> • Prescribe iv Glucose 10% • Start maternal EBM at 2-3 ml if available 2 hourly via Fr 5 or 6 NGT/OGT • Babies \geq 35 weeks gestation at birth can be tried on 3 hourly feeds and higher starting volumes from birth, e.g. starting at 20-30 ml/kg/day, increasing by 20-30 ml/kg/day
First 24-48h	<ul style="list-style-type: none"> • Give iv additives (Na and K) as required • Increase enteral feeds to 2-3 ml 2 hourly as tolerated or higher (see above) • Start Nutriprem 2 if > 1.5 kg or term formula if ≥ 2 kg birth weight at same volume if MEBM not available/insufficient
Day 3 (>48h)	<ul style="list-style-type: none"> • Do not increase enteral feeds if not opened bowels, prescribe regular glycerine spp. • Increase enteral feeds 1 ml 12 hourly if opened bowels once daily • Increase enteral feeds 1 ml 8 hourly if opened bowels >1 per day
Day 4 and above	<ul style="list-style-type: none"> • Consider starting TPN if not tolerating $> 50\%$ feeds after > 5 days • Do not fortify any breast milk until tolerating at least 150 ml/kg/day • Consider bowel washout if bowels not opened after > 5 days despite regular glycerine spp. • Increase enteral feeds 1ml 12 hourly if opened bowels once daily and still meconium • Increase enteral feeds 1ml 8 hourly if opened bowels > 1 per day and still meconium • Increase 1ml 6 hourly if opened bowels once daily and yellow stools • Increase 1ml 4 hourly if opened bowels > 1 per day and yellow stools
Weaning PN	<ul style="list-style-type: none"> • Continue increasing feeds until reaching full enteral feeds of max. 165 ml/kg/day
Establishing growth with enteral nutrition	<ul style="list-style-type: none"> • If not tolerating full feeds suggesting reflux, try in descending order: <ol style="list-style-type: none"> 1. Prone/lateral positioning, ensure 30° mattress tilt 2. 2 hourly feeding with Fr 5 OGT/NGT and holding the syringe with its flange at the height of the junction between the lid and the door of a closed incubator or at the upper margin of the plastic sides of an open incubator or cot. This equates to approx. 12 cm above the baby's head and 10 – 20 min feed. 3. 1 hourly gravity feeding 4. 2 hourly feeding by pump starting at 60 minutes and increasing by 30 minutes to max. 1 h 30 minutes; wean 5 - 10 minutes every day as soon as feeding tolerance established until tolerating 40 minute pump feeds 5. Try 2 hourly gravity feeds or, if not tolerated, 1 hourly gravity feeding again 6. Consider changing to 3 hourly feeds once tolerating 2 hourly feeds for approx. 1 week • Continue with full feeds for approx. 1 week and review tolerance and growth • If not enough MEBM available, then introduce one formula feed of Nutriprem 2 at same volume according to the Scheme below to complement MEBM feeds from birth and do not give DEBM • If on combination of MEBM and formula but not growing, then fortify MEBM with SMA fortifier according to Scheme below • If enough MEBM available but not growing, then fortify MEBM with SMA fortifier according to Scheme below • If enough MEBM available and fully fortified with SMA fortifier at Stage 2 but not growing, then introduce one formula feed of Nutriprem 2 at same volume according to the Scheme below to complement fortified MEBM feeds

SCHEME FOR MEBM FORTIFICATION

Do not fortify DEBM and do not fortify MEBM in any baby < 1.2kg or if volume is < 15ml per feed

Stage 1 fortification (2 hourly feeding)

1. Dissolve 1 fortifier sachet into the volume of 2 cold MEBM feeds (ensure a minimum total volume of 30ml) and mix thoroughly
2. There is no maximum volume of milk that can be used
3. Split the volume into 2 individual feeds, warm one feed (as per guideline) and administer. Label the second feed and store this in the refrigerator to give for the next feed. The two fortified feeds should be given consecutively
4. If growth is not improving, increase by 2 fortified feeds per day following the table below
5. Continue until all feeds are fortified and then review growth for at least 1 week. If growth still not adequate move to stage 2 fortification

Stage 1 (2 hourly feeding)	Always mix 1 fortifier sachet into an MEBM volume equivalent to 2 full feeds	
Step of fortification	Total fortified feeds per day	Regime
Step 1	2	Give 2 consecutive fortified feeds followed by 10 unfortified feeds
Step 2	4	Give 2 consecutive fortified feeds followed by 4 unfortified feeds
Step 3	6	Give 2 consecutive fortified feeds followed by 2 unfortified feeds
Step 4	8	Give 2 consecutive fortified feeds followed by 1 unfortified feed
Step 5	10	Give 2 unfortified feeds 12 hours apart
Step 6	12	Fortify all feeds
Observe growth for at least 1 week before changing to stage 2		

Stage 2 fortification (2 hourly feeding)

1. Dissolve 2 fortifier sachets into the volume of 3 cold MEBM feeds (ensure a minimum total volume of 50ml) and mix thoroughly
2. There is no maximum volume of milk that can be used

3. Split the volume into 3 individual feeds, warm one feed (as per guideline) and administer. Label the second and third feed and store these in the refrigerator and give for the next two feeds. All fortified milk must be used within 6 hours

Stage 2 (2 hourly feeding)	Always mix 2 fortifier sachets into an MEBM volume equivalent to 3 full feeds
Give 12 fortified feeds per day	

Fortification for 3 hourly feeding

1. Fortification steps will depend on whether babies are already receiving fully fortified feeds 2 hourly and changing to 3 hourly feeds or whether babies are already receiving 3 hourly feeds and not receiving fortified feeds
 - a. Babies already receiving fully fortified feeds but changing from 2 to 3 hourly feeds: Dissolve 1 fortifier sachet into the volume of 1 cold MEBM feed (ensure a minimum total volume of 25ml) and mix thoroughly. There is no need for a gradual change.
 - b. Babies not already receiving fortified feeds: Dissolve 1 fortifier sachet into the volume of 1 cold MEBM feed (ensure a minimum total volume of 25ml) and mix thoroughly. Increase the number of fortified feeds as per table below
2. There is no maximum volume of milk that can be used
3. You can stop at any stage if growth improves or continue until all feeds are fortified

3 hourly feeding and not already receiving fortified feeds	Always mix 1 fortifier sachet into the volume of 1 cold MEBM feed (ensure a minimum volume of 25ml)	
Step of fortification	Total fortified feeds per day	Regime
Step 1	1	Give 1 fortified feed followed by 7 unfortified feeds
Step 2	2	Give 1 fortified feed followed by 3 unfortified feeds
Step 3	4	Give 1 fortified feed followed by 1 unfortified feed
Step 4	6	Give 3 fortified feed followed by 1 unfortified feeds
Step 5	7	Give 7 fortified feed followed by 1 unfortified feeds
Step 6	8	Fortify all feeds

SCHEME FOR INTRODUCTION OF FORMULA FEEDING

2 hourly feeding schedule		
Step of formula	Total formula feeds per day	Regime
Step 1	1	Give 1 formula feed followed by 11 human milk feeds
Step 2	2	Give 1 formula feed followed by 5 human milk feeds
Step 3	3	Give 1 formula feed followed by 3 human milk feeds
Step 4	4	Give 1 formula feed followed by 2 human milk feeds
Step 5	6	Give 1 formula feed followed by 1 human milk feed
Review growth for at least 1 week before progressing, unless there is not enough MEBM available or DEBM fed		
Step 6	8	Give 2 formula feeds followed by 1 human milk feed
Step 7	9	Give 3 formula feeds followed by 1 human milk feed
Step 8	10	Give 5 formula feeds followed by 1 human milk feed
Step 9	12	Give all formula feeds

3 hourly feeding schedule		
Day of formula	Total formula feeds per day	Regime
Step 1	1	Give 1 formula feed followed by 7 human milk feeds
Step 2	2	Give 1 formula feed followed by 3 human milk feeds
Step 3	4	Give 1 formula feed followed by 1 human milk feed
Step 4	6	Give 3 formula feeds followed by 1 human milk feed
Step 5	7	Give 7 formula feeds followed by 1 human milk feed
Step 6	8	Give all formula feeds