

# Newcastle upon Tyne Hospitals NHS FOUNDATION TRUST

## Guideline for Initiating Parenteral Nutrition for Term Neonates and Infants up to 6 Months Old using Babiven Maintenance and Modified Babiven Maintenance

### 1. Introduction

This guideline is intended for management of parenteral nutrition (PN) requirements of term neonates and infants up to 6 months of age being cared for in the Newcastle upon Tyne Hospitals. It describes the most commonly used approaches to fluid and electrolyte management. It is not intended to cover all patient groups. Some neonates and infants (for example, those with significant fluid restriction, renal impairment or liver impairment) will require a more individualised approach.

A guideline document for **Fluid Management and Parenteral Nutrition of the Preterm Neonate** (for use on the Special Care Baby Unit) is available on the intranet.

PN for term neonates and infants up to 6 months is provided in two separate containers:-

- I. An aqueous PN solution based on Babiven Maintenance containing glucose, amino acids, electrolytes, minerals, trace elements (as Peditrace) and vitamins (as Solivito).
- II. A lipid emulsion such as Intralipid with added fat soluble vitamins (Vitlipid Infant).

### 2. Intravenous access

PN is best administered via a peripherally inserted central line or a tunnelled central line. Generally, peripheral cannulas are not recommended due to risks of extravasation injury and also the need to change the cannulation site regularly.

Babiven Maintenance should ideally not be used peripherally because it is custom and practice in Newcastle Upon Tyne Hospitals not to give solutions greater than 10% glucose via peripheral cannula. However, Babiven Maintenance is glucose 11% and its osmolality is 978mosmol/Kg so it may be given peripherally at the consultant's discretion.

### 3. Fluid Management

For newborn infants, the guidelines in **table 1** are based on the following fluid increment steps:-

Day 1:	80ml per kg per day
Day 2:	100ml per kg per day
Day 3:	120ml per kg per day
Day 4 onwards:	150ml per kg per day

**Table 2** gives guidance on initiating PN and lipid in a neonate or infant that is already on full fluid requirements of 150ml per kg per day.

Infants up to 6 months of age usually need 100ml to 150ml per kg per day, but this can vary on an individual basis.

### 4. Starting parenteral nutrition

Table 1 and 2 are based on the assumption that the child can follow standard fluid increments. If the child becomes fluid restricted for several days, the rates should obviously be maintained at an appropriate level. This may result in inadequate calories being provided by the parenteral nutrition and this should be addressed on an individual basis.

Table 1 and 2 are guides to starting PN and appropriate rates of infusion. They also show what the PN will provide per kg per day.

Appendix 3 is a quick reference guide for initiating and titrating the lipid infusion upwards in babies under 6 months of age.

**TABLE 1. Guidelines for rates of aqueous PN (using Babiven Maintenance with glucose 11%) and lipid PN in neonates building up to maintenance fluid requirements**

	Day 1 (80ml per kg per day)		Day 2 (100ml per kg per day)		Day 3 (120ml per kg per day)		Day 4 onwards(150ml per kg per day)	
	Aqueous PN	Lipid PN	Aqueous PN	Lipid PN	Aqueous PN	Lipid PN	Aqueous PN	Lipid PN
Fluid Provided (approx ml per kg per day)	75	5	90	10	105	15	133	17
Rate (ml per kg per hour) * <b>OVER 24 HOURS</b>	3.1	0.2	3.7	0.4	4.4	0.6	5.5	0.7
Lipid (kcal/kg/day) **		9		18		27		32
Nitrogen (g/kg/day)	0.27		0.33		0.38		0.49	
Glucose (kcal/kg/day)	33		40		47		59	
Sodium (mmol/kg/day)	1.7		2		2.3		2.9	
Potassium (mmol/kg/day)	1.1		1.4		1.6		2	
Calcium (mmol/kg/day)	0.8		1		1.2		1.5	
Magnesium (mmol/kg/day)	0.11		0.13		0.16		0.2	
Phosphate (mmol/kg/day)	0.8		1		1.2		1.5	
Chloride (mmol/kg/day)	1.1		1.4		1.6		2	
Acetate (mmol/kg/day)	1.1		1.4		1.6		2	
Total calories including protein (kcal per kg per day)	49		66		84		104	

\* if PN is administered over 24 hours

\*\* based on lipid ratio 100ml lipid 20%: 10ml Vitlipid Infant (providing final concentration of 19%)

**TABLE 2. Guidelines for rates of aqueous PN (using Babiven Maintenance with glucose 11%) and lipid PN in neonates and infants less than 6 months old that are already on standard fluid maintenance of 150ml per kg per day**

	Day 1		Day 2		Day 3 onwards	
	Aqueous PN	Lipid PN	Aqueous PN	Lipid PN	Aqueous PN	Lipid PN
Fluid Provided (approx ml per kg per day)	145	5	140	10	135	15
Rate (ml per kg per hour) * <b>OVER 24 HOURS</b>	6	0.2	5.8	0.4	5.6	0.6
Lipid (kcal/kg/day) **		9		18		27
Nitrogen (g/kg/day)	0.53		0.5		0.49	
Glucose (kcal/kg/day)	64		62		60	
Sodium (mmol/kg/day)	3.2		3.1		3	
Potassium (mmol/kg/day)	2.2		2.1		2	
Calcium (mmol/kg/day)	1.6		1.6		1.5	
Magnesium (mmol/kg/day)	0.21		0.2		0.2	
Phosphate (mmol/kg/day)	1.6		1.6		1.5	
Chloride (mmol/kg/day)	2.2		2.1		2	
Acetate (mmol/kg/day)	2.2		2.1		2	
Total calories including protein (kcal per kg per day)	86		93		99	

\* if PN is administered over 24 hours

\*\* based on lipid ratio of 100ml lipid 20% : 10ml Vitlipid Infant (providing final concentration of 19%)

## 5. Lipid

On working days the lipid will be provided from pharmacy with vitamins added in the following concentrations dependent on the baby's weight:-

<b>&lt;3.5kg</b>	<b>100ml lipid 20% : 20ml Vitlipid Infant containing 10% lipid</b> (overall concentration 18.3%)
<b>3.6 kg to 5kg</b>	<b>100ml lipid 20% : 10ml Vitlipid Infant 10% containing 10% lipid</b> (overall concentration 19.1%)
<b>5.1kg to 7kg</b>	<b>200ml lipid 20% : 20ml Vitlipid Infant 10% containing 10% lipid</b> (overall concentration 19.1%)
<b>7.1 to 10kg</b>	<b>200ml lipid 20% : 10ml Vitlipid Infant 10% containing 10% lipid</b> (overall concentration 19.5%)

Nb. The above ratios are a guide and long-term patients will need to have concentrations tailored to their needs

Some children are treated with alternative lipid formulations. Lipofundin and SMOFlipid are commonly used alternatives to Intralipid. They are both also 20% emulsions and can be infused at the same rates suggested throughout this guideline.

## 6. Stopping PN

When enteral feeds are being titrated upwards, Babiven Maintenance and Lipid infusions will need to be reduced.

Care needs to be exercised to ensure that the total fluid volume remains consistent throughout titration. Remember to add the aqueous PN, lipid emulsion and enteral feed volumes together to calculate the total daily input.

A useful rule of thumb is to decrease the Babiven maintenance and lipid in a ratio of 9:1. This keeps the proportion of glucose: protein: lipid at appropriate amounts.

### Example:

Enteral feeding rate                      Peptijunior given 10ml every two hours = 120ml per day  
Therefore a 5ml per hour reduction in PN and lipid rate is required when infused over 24 hours

Plan    Reduce lipid rate by 0.5ml per hour  
Reduce Babiven Maintenance rate by 4.5ml per hour

## 7. Hyperglycaemia

If hyperglycaemia develops while on PN, initial management in Newcastle upon Tyne Hospitals is to reduce the glucose content of the aqueous PN bag. There will be an option available for a standard aqueous PN bag which is very similar in content to Babiven Maintenance, but will contain 5% or 7.5% glucose and less protein. These bags will need to be ordered from pharmacy on an individual basis on working days only. See Appendix 1 for details.

Insulin use may also be considered if the hyperglycaemia is prolonged and the consultant deems it necessary.

## 8. Fluid Restricted Patients

More concentrated aqueous PN bags will be available for fluid restricted patients. They will be very similar in formulation to Babiven maintenance, but will contain 12.5% glucose or 15% glucose. These bags will need to be ordered from pharmacy on an individual basis on working days only. See Appendix 2 for details.

## 9. Out of Hours Supply of Babiven Maintenance 500ml bags

Babiven Maintenance is available on Paediatric Intensive Care Unit and Paediatric Surgical wards for use outside of pharmacy working hours.

PN is generally **NOT** an emergency and use of these bags should be restricted to pre-term neonates and neonates born with immediate feeding complications e.g. gastroschisis.

Out of normal working hours, 100ml bags of Intralipid 20% are available on Paediatric Intensive Care Unit and Paediatric Surgical wards. They can be infused at the rates suggested in table 1 and 2. **They do not require the addition of vitamins. These should only be added in the Pharmacy Production Unit.**

## 10. Further Recommendations

- No additions can be made to the Babiven Maintenance or lipid on the ward. This must only be done in a pharmacy aseptic unit
- Bags, syringes and giving sets that contain PN components should be protected from light wherever possible
- Drugs should ideally not be infused via the same line as PN and lipid. Call Pharmacy Medicines Information (25398) if any doubt.
- Do not reconnect PN to a line if it becomes disconnected.
- Do not alter PN rates to replace gastrointestinal fluid losses. This fluid should be replaced with an appropriate crystalloid

- Regular blood and growth monitoring is required and a locally agreed policy is available on the Intranet.
- PN is normally given to neonates over 24 hours. A separate policy regarding 'cycling PN' i.e. time off PN is in the process of being developed.

**Details of Modified Babiven Maintenance with reduced glucose (5% and 7.5%) and protein for hyperglycaemic patients**

	<b>Modified Babiven Maintenance 5% glucose</b>		<b>Modified Babiven Maintenance 7.5% glucose</b>	
	<b>Based on fluid of 150ml per kg per day</b> (Aqueous PN 135ml per kg per day and lipid PN 15ml per kg per day)		<b>Based on fluid of 150ml per kg per day</b> (Aqueous PN 135ml per kg per day and lipid PN 15ml per kg per day)	
	Total PN bag contents	Provides per kg per day (if 135ml per kg per day is delivered)	Total PN bag contents	Provides per kg per day (if 135ml per kg per day is delivered)
Fluid volume (ml)	500ml	135ml	500ml	135ml
Nitrogen (g)	1.4	0.38	1.4	0.38
Glucose (kcal)	100	27	150	41
Sodium (mmol)	11	3	11	3
Potassium (mmol)	8	2.2	8	2.2
Calcium (mmol)	5.5	1.5	5.5	1.5
Magnesium (mmol)	0.8	0.2	0.8	0.2
Phosphate (mmol)	5.5	1.5	5.5	1.5
Chloride (mmol)	11	3	11	3
Acetate (mmol)	8	2.2	8	2.2

Appendix 2

**Details of Babiven Maintenance with increased glucose (12.5% and 15%) for fluid restricted patients**

	Modified Babiven Maintenance 12.5% glucose		Modified Babiven Maintenance 15% glucose	
	Based on fluid of 120ml per kg per day (Aqueous PN 105ml per kg per day and lipid PN 15ml per kg per day)		Based on fluid of 100ml per kg per day (Aqueous PN 85ml per kg per day and lipid PN 15ml per kg per day)	
	Total PN bag contents	Provides per kg per day (if 105ml per kg per day is delivered)	Total PN bag contents	Provides per kg per day (if 85ml per kg per day is delivered)
Fluid volume (ml)	526ml	105ml	556ml	85ml
Nitrogen (g)	1.83	0.37	1.83	0.28
Glucose (kcal)	262	52	322	49
Sodium (mmol)	11.2	2.2	11.2	1.7
Potassium (mmol)	7.5	1.5	7.5	1.1
Calcium (mmol)	5.55	1.1	5.55	0.8
Magnesium (mmol)	0.81	0.16	0.81	0.12
Phosphate (mmol)	5.6	1.1	5.6	0.9
Chloride (mmol)	7.4	1.5	7.4	1.1
Acetate (mmol)	7.5	1.5	7.5	1.1

**Instructions for commencing lipid infusions as part of parenteral nutrition regimen in neonates and babies up to 6 months of age in Children's Services Directorate.**

**INFUSION RATES WHEN USING A 20% LIPID EMULSION SHOULD BE:-**

**DAY 1:** Infuse 1g/kg/day = 0.2ml/kg/hour for 24 hours

**DAY 2:** Infuse 2g/kg/day = 0.4ml/kg/hour for 24 hours

-----CHECK TRIGLYCERIDE AND CHOLESTEROL LEVEL-----

**DAY 3:** Infuse 3g/kg/day = 0.6ml/kg/hour for 24 hours

**DAY 4:** Infuse 3.5g/kg/day = 0.7ml/kg/hour for 24 hours

On working days the lipid will be provided from pharmacy with vitamins added in the following concentrations dependent on weight:-

**<3.5kg**                    **100ml lipid 20% : 20ml Vitlipid Infant containing 10% lipid (overall concentration 18.3%)**

**3.6kg to 5kg**            **100ml lipid 20% : 10ml Vitlipid Infant 10% containing 10% lipid (overall concentration 19.1%)**

**5.1kg to 7kg**            **200ml lipid 20% : 20ml Vitlipid Infant 10% containing 10% lipid (overall concentration 19.1%)**

**7.1 to 10kg**            **200ml lipid 20% : 10ml Vitlipid Infant 10% containing 10% lipid (overall concentration 19.5%)**

Out of normal working hours, 100ml bags of Intralipid 20% are available on Paediatric Intensive Care Unit and Paediatric Surgical wards. **They do not require the addition of vitamins. This should only be done in the Pharmacy Production Unit.**

**Contents of Babiven Maintenance (glucose 11%) 500ml and 1L bag (plus suggested amounts for addition of vitamins and trace elements)**

Composition	500ml Babiven Maintenance	1L Babiven Maintenance
Glucose (kcal)	222	444
Nitrogen (g) <small>VAMINOLACT</small>	1.83	3.65
Calcium (mmol)	5.56	11.11
Phosphate (mmol)	5.55	11.1
Magnesium (mmol)	0.74	1.48
Potassium (mmol)	7.5	15
Sodium (mmol)	11.1	22.22
Acetate (mmol)	7.5	15
Chloride (mmol)	7.4	15
Peditrace (ml)	4	8
Solivito N (ml)	4	8
Osmolality (mosmol/Kg)	978	

**Contents of modified Babiven (glucose concentrations 5%, 7.5%, 12.5% and 15%)**

Composition	500ml Babiven Modified 5% glucose	500ml Babiven Modified 7.5% glucose	525ml Babiven Modified 12.5% glucose	555ml Babiven Modified 15% glucose
Glucose (kcal)	100	150	262	322
Nitrogen (g) <small>VAMINOLACT</small>	1.4	1.4	1.83	1.83
Calcium (mmol)	5.5	5.5	5.55	5.55
Phosphate (mmol)	5.5	5.5	5.6	5.6
Magnesium (mmol)	0.8	0.8	0.8	0.8
Potassium (mmol)	8	8	7.5	7.5
Sodium (mmol)	11	11	11	11
Acetate (mmol)	8	8	7.5	7.5
Chloride (mmol)	11	11	7.4	7.4
Peditrace (ml)	4	4	4	4
Solivito N (ml)	4	4	4	4
Osmolality (mosmol/Kg)	539	696	1066	1189