Waikato District Health Board

Guideline

Fluid Orders for Neonates

Guideline Responsibilities and Authorisation

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Guideline Review History

Version	Updated by	Date Updated	Summary of Changes
6	David Bourchier	May 2016	Update
7	Phil Weston & Arun Nair	Feb 2022	Update
7.1	Arun Nair	Apr 2022	Amendment of Appendix B

Fluid Orders for Neonates

Contents

1 Overview

1.1 Purpose

To provide a guideline for neonatal fluid administration and parenteral nutrition.

1.2 Scope

All Waikato District Health Board (DHB) medical and nursing staff.

1.3 Patient / client group

Neonates.

1.4 Definitions and acronyms

BW	Birth Weight
CVAD	Central Venous Access Device
EBM	Expressed Breast Milk
HMF	Human Milk Fortifier
PIVC	Peripheral Intra Venous Cannula
REG96	Standard amino acid plus Dextrose solution for use in parenteral nutrition
SMOFlipid	Sterile, nonpyogenic, white, homogenous lipid emulsion for intravenous infusion. The lipid content of Smoflipid is 0.20 g/mL and comprises of **S**oyabean oil**, M**edium Chain Tryglerides **(**MCTs**), O**live oi**l,** and **F**ish oil.
UVC	Umbilical Venous Catheter

2 Clinical management

2.1 Guideline

2.1.1 Fluids

a) The standard volume of fluid prescribed varies with Birth Weight :

- Babies with Birth Weight =/< 1500g*

Day 0 / Day 1	75 mL/kg/day
Day 2	90 mL/kg/day
Day 3	120 mL/kg/day
Day 4	150 mL/kg/day
Day 5	180 mL/kg/day

- For babies with Birth Weight > 1500g start with 60mL/Kg and increase by 30mL/Kg every day till 150mL/Kg/day

*Can be adjusted as per the clinical situation at the discretion of the consultant

b) Infants who are small for gestational age (BW <10th centile) begin at 90mL/kg/day on Day 1 and progress to 150mL/kg/day by Day 3.

c) Infants with Respiratory Distress Syndrome are maintained on 75 mL/kg day for several days, until diuresis has occurred (urine output of > 2 ml/kg/hr)

d) Post-operative infants (major surgery only) are restricted to maintenance fluids of 90 mL/kg/day for 48 hours in the immediate post op period

NB Specific Additional fluids (such as blood products and insulin) are given in addition to the maintenance requirements

e) The type of fluid and route of administration varies with the clinical situation:

1) For all babies with birth weight ≤ 1500g or for those who cannot be fed enterally - PIVC or CVAD 10% dextrose or Parenteral Nutrition Fluid REG96 solution plus Lipids (with additional fluid and additional electrolytes if needed).

2) Babies with BW >1500g or well term infants - begin on enteral feeds immediately (breast milk is preferred but formula is also permissible with parental consent).

f) Chart parenteral fluids to the nearest 0.01mL/h

2.1.2 Enteral Feeding

a) Type

- **Breast milk** is the feed of preference in all infants initially, consider donor EBM for infants less < 30/40. Following attainment of 8 mL volumes of feeds, breast milk may be fortified with Human Milk Fortifier (FM85) (1 stick/25mL) in infants of birthweight <1800g or <32/40. HMF should be continued until near to hospital discharge. Do not mix fortified EBM with infant formula.

- **Infant formula**: preterm formula (PTF) for infants <2000g or Term Formula is to be used in place of or in combination with breast milk when adequate amounts of breast milk is unavailable in consultation with the mother.

b) Method:

≤1500g - 2 hourly Bolus

> 1500g - 3 hourly Bolus

For feed escalations refer to Enteral Feeding: Standardisation of Feeding in Newborn Intensive Care Unit (NICU) guideline and Necrotising Enterocolitis Care Bundle in Newborn Intensive Care protocol.

c) Do not aspirate to check for feed tolerance routinely and if aspirated as part of air evacuation of the stomach, it should be returned to the stomach immediately, unless the aspirate has a strong blood component, or there is suspicion of a bowel obstruction. However, placement of gastric tube must be checked regularly, and pH of aspirate documented.

d) Feed intolerance (excessive vomiting) in otherwise well babies can be managed by continuous gastric feeding of expressed breast milk (EBM) / infant formula OR "compressed" gastric feeds over 30 or 60 minutes OR continuous transpyloric feeds

(Note: Only feeds with osmolality < 450 mosm/ L should be given transpyloric, do not use fortified EBM, also check/calculate osmolality if supplements are being added to the transpyloric fed milk).

e) Chart feeds to nearest 0.5mL if < 10 ml volume/feed, nearest 1mL if > /= to 10 ml/feed

2.1.3 Intravenous Nutrition (IVN) – (REG96+SMOFlipid

(See Appendix A – Neonatal Intravenous Nutrition Formulations)

Run REG96 and Lipid over 24 hours unless restricted for Liver Sparing. If restricted for 20 hrs, make up the rest of the 4 hours volume with 10% Dextrose.

Infuse via CVAD/UVC, PIVC can be used when there is no CVAD/UVC available

For PIVC administration, need to administer REG96 along with lipid, as it is protective for veins and reduces the effect of extravasation

a) Protein(AA)-Dextrose Solution: There is only one standard mixture available, "REG96", for use in all babies from the initiation of IV nutrition (See Appendix A for composition, tables as below for nutritional requirement)

On the first day (Day 0 and Day 1) it should comprise up to 60 mL/kg/day, leaving residual infusions (arterial, medications) to make up the difference to a total of 75 mL/kg/day in babies with Birth Weight =/< 1500g. (if the calculated total volume still exceeds 75 ml/kg/day, cut back on the TPN volume appropriately).

On subsequent days it should be used at a volume that allows all infusions be administered, up to the maximums described below:

- The Reg96 fluid volumes can go to maximum of
  - 96 mL/kg/day if BW ≤ 1000g
  - 90 mL/kg/day if BW > 1000g and gest ≤ 34 weeks
  - 70 mL/kg/day if Gest > 34 weeks

b) Lipid Solution: 20% lipid emulsion (SMOF lipid)

Day 1: 10 mL/kg/day ≈ 2 g/kg/day

Day 2: 20 mL/kg/day ≈ 4 g/kg/day

There are two SMOF lipid preparations, preterm and term. The term solution comes in 2 volumes (150ml and 300ml, see Appendix A – Neonatal Intravenous Nutrition Formulations)

- (See Tables A & B for compositions)

- For infant with birthweight ≤1500g start with Preterm SMOF lipid
  a. when infants with birthweight ≤1500g reaches 34 weeks CGA change from Preterm Lipids to Term Lipids
- For infant with birthweight of >1500g start with Term SMOF lipid

(See Appendix B – Details for Fluid & TPN Charting)

c) Criteria for consideration of electrolyte supplementation:

Serum Sodium	<135 mmol/L
Serum phosphate	<1.4 mmol/L
Serum total calcium	<1.5 mmol/L (albumin adjusted)
Serum Potassium	<3.0 mmol/L
Serum Magnesium	<0.7 mmol/L

See:

- Phosphate IV for neonates drug guideline
- Calcium Chloride for neonates drug guideline
- Potassium Chloride for neonates drug guideline

e) **Refeeding syndrome**: This biochemical disorder arises when protein is taken up for anabolic purposes without appropriate supportive administration of phosphate, potassium and magnesium. It is associated with adverse outcomes, and all babies under 1500g are to be screened for it by measuring phosphate, calcium and magnesium on days 3, 5, 7, and 14.

Refeeding syndrome is present when Phosphate < 1.2mmol/L, and total calcium >2.8mmol/L.

Details on REG96 administration

Table A Protein, Glucose & Mineral contents *(Add in lines and shading as per Waveney' request for the headings, please)*

	Gest < 34 weeks			Gest >34 weeks	
Reg96	For Bwt =/< 1000g (300 ml bag) @96ml/kg	For Bwt> 1000g(600ml bag) @90ml/Kg	ideal	(1000ml bag) @ 70ml/Kg	ideal
Protein g	4	3.8	2.5-3.5	2.9	1.5-3
Glucose g	9.6	9	12-14	7	7-14
Sodium mmol	5.3	5	2-5	4	2-5
Potassium mmol	2.7	2.5	2-3	2	2-3
Chloride mmol	1.9	2.25	2-5	1.3	2-5
Gluconate mmol	0	0	.	0	.
Acetate mmol	3.65	2.97	.	2.9	
Calcium mmol	1.6	1.5	1.6-3.5	1.2	0.8-1.5
Phosphate mmol	1.8	1.7	1.6-3.5	1.3	0.7-1.3
Magnesium mmol	0.3	0.25	0.2-0.3	0.2	0.1-0.2
Zinc mg	0.4	0.4	0.4-0.5	0.3	0.25
Heparin units	48	45	.	35	.
Manganese mcg	1.06	1	0-1	0.8	0-1
Copper mcg	21	20	40	15	20
Chromium mcg	0.21	0.2	0	0.15	0
Iodine mcg	1.1	1	1-10	0.8	1-5
Selenium mcg	7.4	6.9	6-7	5.4	2-3

Note: "ideal" is as given by ESPGHAN recommendations 2018: Green font means within ideal target range. Red font means below ideal target range, to be aware of/monitored. Blue means over the target range but not for monitoring.

Calories*

At 96mL/Kg made up to 180ml/kg with additional 10% Dextrose: (Ideal for Preterm Babies 90-120 Cal/Kg/D)

Total Cals 124/kg/D (16 Cal/Kg from Protein (12.9%), 72 Cal/Kg from Glucose (58.1%) and 36 Cal/Kg from Fat (29%)

At 90mL/Kg made up to 180ml/kg with additional 10% Dextrose: (Ideal for Preterm Babies 90- 120 Cal/Kg/D)

Total Cals 123.2/kg/D (15.2 Cal/Kg from Protein (12.3%), 72 Cal/Kg from Glucose (58.4%) and 36 Cal/Kg from Fat (29.3%)

At 70mL/Kg made up to 150ml/kg with additional 10% Dextrose: (Ideal for Term Babies 75-120 Cal/Kg/D)

Total 111.4/kg/D (15.4Cal//Kg from Protein (13.8%), 60Cal /Kg from Glucose (53.9%) and 36 Cal/Kg from Fat (32.3%)

The ideal distribution of calories should be 10%-15% from protein, 60% from carbohydrate and 30% from fat

Details on lipid administration

Preterm lipid syringe 55 mL has Infuvite 5mL (4mL vial 1 + 1mL vial 2) + 50mL SMOF and 0.8 mmol of Phosphate

Term lipid bag 150 mL has Infuvite 10mL (8mL Vial 1 + 2ml vial 2) + 140mL SMOF and 2.1 mmol of phosphate

Term lipid bag 300 mL has Infuvite 20mL (16mL vial 1 and 4mL vial 2) + 280mL SMOF and 4.2 mmol of Phosphate

Table B : Vitamin Content

	Preterm Lipid				Term Lipids			
	Syringe 55mL	Per mL	@ 20ml/kg /day	Ideal/kg/ day	Bag 150ml / 300 mL	Per mL	@ 20ml/kg/ day	Ideal/kg/ day
A (IU)	2300	41.82	836	700-1500	9200	30.67	613	495-990
D (IU)	400	7.27	145	80 - 400	1600	5.33	107	40 -150
E (IU)	7	0.13	2.5	2.8 -3.5	28	0.09	1.9	2.8 – 3.5
K (mcg)	200	3.64	72.7	10	800	2.67	53.3	10
Thiamine B1 (mcg)	1200	21.82	436	350 -500	4800	16.00	320	350 – 500
Riboflavin B2 (mcg)	1400	25.45	509	150-200	5600	18.67	373	150 – 200
Niacin B3 (mg)	17	0.31	6.2	4 – 6.8	68	0.23	4.5	4 – 6.8
Pantothenic B5 (mg)	5	0.09	1.8	2.5	20	0.07	1.3	2.5
Pyridoxine B6 (mcg)	1000	18.18	364	150 -200	4000	13.33	267	150 – 200
Cobalamin B12 (mcg)	1	0.02	0.36	0.3	4	0.01	0.27	0.3
C (mg)	80	1.45	29.1	15 – 25	320	1.07	21.3	15 – 25
Biotin (mcg)	20	0.36	7.3	5 - 8	80	0.27	5.3	5 – 8
Folic Acid (mcg)	140	2.55	50.9	56	560	1.87	37.3	56

Note: “ideal” is as given by ESPGHAN recommendations 2018: Green font means within the acceptable ideal target range. Red font means below the ideal target range and to be aware of/monitored. Blue means over target range but not for monitoring.

2.2 Conversions Used

Vitamin A:	Retinol palmitate	1mcg = 3.3 IU
Vitamin D:	Cholecalciferol or Ergocalciferol	1mcg = 40 IU
Vitamin E:	Tocopherol	1mg = 1.1 IU

Nutrient composition of human milk fortifier (HMF, "Pre-NAN FM85" by Nestle) according to box info (note each sachet has 1 g which is added to 25 ml milk):

Amount of fortifier	1 gram
Energy (kcal)	18
Protein (g)	0.36
Carbohydrate (g)	0.32
Fat (g)	0.18
Calcium (mg)	18.9
Phosphorus (mg)	11
Sodium (mg)	9.18
Chloride (mg)	8.03
Potassium (mg)	12.1
Magnesium (mg)	1.52
Iron (mg)	0.45

2.3 Potential complications

- Standard complications related to Central & Peripheral lines viz infiltration, extravasation & infection
- Over/Undernutrition, fluid overload, dehydration etc. & its related complications

2.4 After care

Depending on the complications, specific measures may have to be instituted.

3 Audit

3.1 Indicators

- Growth monitoring
- Nutritional assessments

3.2 Tools

- Discharge details and database

4 Evidence base

4.1 Bibliography

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- Adjustable fortification of human milk fed to preterm infants does it make a difference? – J. Perinatol. 2006 Oct; 26(10):614-21. Epub 2006 Aug 3.
- Starship neonatal nutrition guideline (2021) https://starship.org.nz/guidelines/nutrition-neonatal-nutrition-guideline/
- Neonatal parenteral nutrition NICE guideline Published: 26 February 2020 www.nice.org.uk/guidance/ng154

4.2 Associated Waikato DHB Documents

- Enteral Feeding: Standardisation of Feeding in Newborn Intensive Care Unit (NICU) guideline (Ref. 6172)
- Necrotising Enterocolitis Care Bundle in Newborn Intensive Care protocol (Ref. 6171)
- Phosphate IV for neonates drug guideline 9Ref. 6370) (
- Calcium Chloride for neonates drug guideline (Ref. 0594)
- Potassium Chloride for neonates drug guideline 9Ref. 2955)

Appendix A – Neonatal Intravenous Nutrition Formulations

Neonatal Reg96 Solution

Volume: Composition:	300 mL	600 mL	1000 mL
Protein g	12.6	25.2	42
Glucose g	30	60	100
Sodium mmol	16.5	33	55
Potassium mmol	8.4	16.8	28
Chloride mmol	6	15	?
Acetate mmol	11.4	19.8	41
Calcium mmol	5.1	10.2	17.02
Phosphate mmol	5.7	11.4	19
Magnesium mmol	0.9	1.8	2.8
Zinc mg	1.32	2.64	4.4
Heparin units	150	300	500
Manganese mcg	3.51	6.48	11
Copper mcg	66	132	220
Chromium mcg	0.64	1.31	2.21
Iodine mcg	3	6.6	11
Selenium mcg	9.3	18.6	30.9

Neonatal Lipid Formulations

Volume: Composition:	Pre-Term Neonatal Lipid emulsion 55 mL syringe	Term Neonatal Lipid emulsion 150 mL bag	Term Neonatal Lipid emulsion 300 mL bag
Lipid (SMOF) g	10	28	56
Multivit. (Infuvite) mL	5	10	20
Phosphate mmol	0.8	2.1	4.2

Appendix B – Details for Fluid & TPN Charting

Preterm Babies*

	Total Fluids ml/kg/day	Reg 96		<1500g: Preterm SMOF ≥1500g: Term SMOF
		≤1000g	>1000g	
Day 0/1	75	60 (up to)	60 (up to)	10
Day 2	90	70 (up to)	70 (up to)	20
Day 3	120	96 (up to)	90 (up to)	20
Day 4	150	96	90	20
Day 5	180	96	90	20

Term Babies*

Total Fluids ml/kg/day	Reg 96	Term SMOF
60	50 (up to)	10
90	70 (up to)	20
120	70	20
150	70	20
150	70	20

Note:

- * For the purposes of TPN -
  - Preterm is < 34 weeks gestation
  - Term is ≥34 weeks gestation
- If SGA (BW<10th centile) start one column lower (ie 90 ml/kg/day)
- Post op – maintain at 90 ml/kg/day for 48 hours
- RDS – stay at 75 ml/kg/day until diuresis has occurred
- Reduce Reg96 volume if needed to accommodate for additional fluids
- When hypernatremia is noted baby may need extra fluid @ 30ml/kg , this could be sterile water or D10% depending on the glucose status