

Nutrition in the premie World

DR VISH SUBRAMANIAN MD MRCP (UK) FAAP
NEONATAL CRITICAL CARE
MERCY CHILDRENS HOSPITAL, SPRINGFIELD MO

SURVIVAL AND GROWTH – NUTRITION ESSENTIALS



Prematurity

- ▶ Birth before completion of 37 weeks
- ▶ Chronological age: Time since actual birth
- ▶ Corrected Age: Chronological age minus number of weeks preterm
- ▶ BIRTHWEIGHT
- ▶ BW is obtained within the first hour
- ▶ Low birth weight: <2500 g
- ▶ Very Low Birth weight: <1500g
- ▶ Extremely Low BW: <1000g

Nutritional Requirements

- ▶ Preterm infants have higher nutrient requirements than Term
- ▶ Parenteral nutrition is necessary initially as enteral feeds are started and slowly established
- ▶ Working Weight: Could be BW, actual weight or dry weight
- ▶ Dry weight: weight when not fluid overloaded

GROWTH RATE / ENERGY REQ

- ▶ Intrauterine growth rate : ~15g /kg/day
- ▶ ENERGY and PROTEIN two major nutrients which matter for growth
- ▶ ENERGY:
 - ▶ Preterm: 110-135 kcal/kg/day
 - ▶ Term: 96-120 kcal/kg/day

FLUIDS

Low fluid status (Dehydration)

- results in
- ▶ Hypovolemia(cap refill >3 secs)
 - ▶ Hyperosmolarity(>305)
 - ▶ Metabolic acidosis(<20 HCO₃)
 - ▶ Renal failure



FLUIDS

Excessive fluid administration results in

- ▶ Hypervolemia (edema)
- ▶ Hypo-osmolality (<270)
- ▶ Pulmonary edema
- ▶ Cardiac Failure
- ▶ Patent ductus arteriosus
- ▶ IVH
- ▶ NEC
- ▶ Bronchopulmonary dysplasia

What to expect in first week

- ▶ Expect weight loss ~10% in first week of life
- ▶ Loss may be upto 20% in BW <750 grams
- ▶ Intrapartum fetal distress – reduced urine output and hence less fluid requirement
- ▶ Urine output directly reflects blood pressure and intravascular volume in premature infant

Osmolality

- ▶ Ideal Plasma Osmolality - 290 +/- 5
- ▶ Range: 280 to 300
- ▶ <270 – fluid retention or overload
- ▶ >305 – Fluid depletion or dehydration
- ▶ Corresponding Sodium
 - Hyponatremia >145
 - Hyponatremia <130

Recommendations

Initial fluid therapy

- ▶ <28 weeks D5W 100
- ▶ 28-32 weeks D7.5 – 10 W @ 80-90
- ▶ >32 weeks D10W @ 80
- ▶ Intrapartum fetal distress/perinatal hypoxia
D10W @ 60-70 cc/kg

Parenteral Nutrition

- ▶ Concept
 - ▶ Starvation is not ideal when under stress
 - ▶ Parenteral nutrient administration is backbone
 - ▶ Enteral nutrition when possible to nourish the gut
 - ▶ Smaller the infant, greater the urgency
 - ▶ TPN commenced ASAP as feasible

Parenteral Nutrition

- ▶ Protein: Max 4G/kg/day (upto 4.5G/kg in extreme premies)
- ▶ CHO: Max @ 20% to provide calories (watch for hypoglycemia)
- ▶ SMOF LIPIDS (Soya/MCT/Olive/Fish):
Max 2.5 Gm/kg/day (Monitor TGL <150)
Advantage: Prevents PNALD
- ▶ ELECTROLYTES

Parenteral Nutrition

- ▶ Calcium – maintain ionised Ca^{++} >1.1
- ▶ Phosphorus – Maximize without precipitate
- ▶ Cystein: essential AA for premature babies
- ▶ Carnitine: essential for lipid metabolism
- ▶ Vitamins including vitamin C
- ▶ Trace Minerals: Trace element/Zinc/selenium
- ▶ Add Vitamin C and Zinc postoperative

Prevention of Osteopenia Of Prematurity

- ▶ Maximize Calcium and Phosphorus to prevent osteopenia
- ▶ The max. Ca/P ratio depends on amount of protein and glucose in TPN
- ▶ Bone labs (LFT) every week in VLBW/ extreme prematurity

PROTEIN REQ

- ▶ PRETERM INFANT <1000G
 - ▶ 4-4.5 G/KG/DAY
- ▶ PRETERM INFANT. 1000-1800G
 - ▶ 3.5-4G/KG/DAY
- ▶ PRETERM/ TERM INFANT: >1800 GRAMS
 - ▶ 3-3.5G/KG/DAY

Probiotics and Prebiotics

- ▶ Experimental at this time but promising
- ▶ Improves gut health by modifying bacterial flora
- ▶ Probiotic: A live microbial feed supplement which beneficially affects the host animal by improving its intestinal microbial balance." [Wikipedia](#)
- ▶ Breast milk contains prebiotics and probiotics which together exert a favourable effect on the bacterial flora of the preterm gut. It is acknowledged that probiotics may have a role in reducing the incidence of NEC and late onset sepsis
- ▶ Example: Risaquad (yeast and lactobacillus etc)

BREAST MILK – MATERNAL AND DONOR

As compared to Formula

- ▶ IMMUNE PROTECTION
- ▶ SUPERIOR NUTRIENT BIOAVAILABILITY
- ▶ IMPROVED FEED TOLERANCE
- ▶ NEURODEVELOPMENTAL ADVANTAGES
- ▶ BETTER LONG TERM OUTCOMES

Note: BF mother's should take additional Vit D and Vit B12 (vegan).

FORTIFICATION OF BREASTMILK

- ▶ HUMAN MILK FORTIFIER - POWDER VS LIQUID, ACIDIFIED VS NONACIDIFIED, BM based
- ▶ Fortifiers are a source of calcium phosphorus apart from calories and protein
- ▶ Neonates on Breastmilk should be supplemented with
 - ▶ Iron
 - ▶ Multivitamins (folic acid)
 - ▶ Phosphate, Sodium
 - ▶ Cholecalciferol supplements when on 50% feeds
 - ▶ 200 iu for less than 1500 g
 - ▶ 400 iu for >1500 g

Feeding Protocol

- ▶ Necessary in high risk infants
 - ▶ <28 weeks, < 1000 grams
 - ▶ Hemodynamically unstable, on inotropes
 - ▶ Previous NEC, high risk of NEC
 - ▶ Recent abdominal surgery
 - ▶ Growth restricted infants
- a) Phase 1 (day 1-4) 10 mls/kg of trophic feeds Q4
- b) Phase 2 (day 5-8) 20 mls/kg of trophic feeds Q4
- c) Phase 3 (daily advance of 20 mls/kg/d)

DONOR BREAST MILK

- ▶ Used as a short term as a tool before establishing mother's expressed breastmilk as full enteral feeds
- ▶ Nutritional content varies. Close nutritional monitoring is advocated
- ▶ Generally transition to preterm formula at 34 weeks or solely maternal breast milk based.

PRETERM FORMULA

- ▶ Type used depends on the flavor of the year based on Hospital
- ▶ Advocated in all preterm babies / LBW (<2000g)
- ▶ Can be used a supplement to breast milk
- ▶ Good content of Calcium and Phosphorus
- ▶ Some iron but will need fortification
- ▶ Use only ready to feed formula in premature babies
- ▶ Powder formula can be used at CGA of 37 weeks or more.

Specialty Formula

- ▶ Partially hydrolysed Formula
 - ▶ Gentlease
- ▶ Extensively Hydrolysed Formula
 - ▶ N LGG, Alimentum
- ▶ Aminoacid Formula
 - ▶ Nutramigen Puramino, Neocate, Elecare

Nutritional Supplements

- ▶ IRON : Upto 4mg/kg/day of elemental iron (Formula has ~ 1.5)
- ▶ MULTIVITAMINS: 1ml once daily
- ▶ CHOLECALCIFEROL: Upto 400 iu until Multivitamins started
- ▶ CALCIUM & PHOSPHORUS Supplement: selected infants

FEEDING INTOLERANCE

- ▶ Persistent large gastric residuals
- ▶ Emesis
- ▶ Bile stained aspirates
- ▶ Abdominal distension / discoloration
- ▶ Blood in stool
- ▶ Liquid stools or increased frequency

FEEDING ROUTE

- ▶ No advantage of continuous feeding over bolus feeding
- ▶ Continuous feeding is useful in infants with
 - ▶ Short gut, s/p gut resection
 - ▶ Severe respiratory problems
 - ▶ High output stomas

Growth Monitoring

- ▶ Length weekly
- ▶ OFC (head circumference) Weekly
- ▶ Weight daily (Aim for average 15g/kg/day of gain)
- ▶ POST DISCHARGE
 - ▶ May need Phosphorus supplementation
 - ▶ Discharged home on higher calorie formula (22 or 24 cal)

Feeding happy,
healthy babies
together



Thank
you

