
# *In The Name Of God*

# *Post Discharge Follow-Up Of High Risk Infants*

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# *A Case Of High Risk Infant*

- ***A 42 days old preterm infant with GA 29 weeks & birth weight 1100 grams is discharged from the hospital.***

- ***What Are Your Follow Up Recommendations?***

# The High-Risk Infant

- The preterm infants (**Extremely preterm, Very preterm** ) are the vast majority of high-risk infants.
- The World Health Organization (WHO) defines preterm infants as
  - **Extremely preterm** infants: **≤ 28 wk** gestational age *
  - **Very preterm** infants: **28 - 31 wk, 6 days** gestational age*
  - **Moderate to Late preterm** infants: 32 – 36 wk, 6 days
- Classification based on birthweight:
  - **Extremely low birthweight** (ELBW): birthweight **<1000 g***
  - **Very low birthweight** (VLBW): birthweight **<1500 g***
  - **Low birthweight** (LBW): birthweight <2500 g

# *High Risk Infants With Birth weight >1500 grams or gestational age of ≥ 32 weeks and one of the following conditions:*

- Infants with **intrauterine growth retardation**
- **Asphyxia** during or before childbirth
- **Severe persistent unstable condition** in infancy (hypoxia, acidemia, hypoglycemia or prolonged hypotension resistant to treatment with pressors)
- **Persistent apnea** requires medical treatment at the time of discharge
- **BPD** or **CLD**
- **Seizure** disorder
- **Persistent pulmonary hypertension** of the newborn
- **Intraventricular hemorrhage** (grade≥ 2), periventricular leukomalacia (**PVL**)
- **Polycythemia** and **partial exchange**
- Major congenital anomaly

# *Follow-up Schedule After Discharge*

- *The first follow-up is **24 to 48 hours** after discharge*
- *Next follow-up:*
  - *For babies weighing **1500-2000 gr** are **once a week***
  - *For babies weighing **more than 2000 gr** are **every 2 weeks***
  - *For **four to six weeks** after discharge then **monthly** or **every two months (**in normal growing infants**)***

# *High Risk Infants Are At Increased Risk For Long-term Complication*

- ***Neurodevelopmental** Sequelae*
  - *Cognitive delay*
  - *Cerebral palsy (CP)*
  - *Fine and gross motor coordination problems*
  - *Learning disabilities*
- ***Visual and Hearing Problems***
- ***Medical Problems***
  - *Respiratory*
  - *Cardiovascular*
  - *Growth issues*

# Respiratory Health

- *Approximately 23% of VLBW infants and 40% of ELBW infants develop **bronchopulmonary dysplasia (BPD)***
  - *BPD: O2 dependence beyond 28 days with the severity assessed at 36 weeks' postmenstrual age (PMA)*
- ***short** and **long term** respiratory **morbidities**:*
  - *acute respiratory exacerbations, upper and lower respiratory infections, pulmonary hypertension, cor-pulmonale, growth failure, and developmental delay, asthma-like symptoms, lack of catch-up growth in lung function*
- *commonly, infants with **significant BPD** may be discharged **home** on some combination of **supplemental O2**, **bronchodilator**, **steroid**, and/or **diuretic therapy**.*

# *Respiratory Health*

- *VLBW infants are **4 times** more likely to be **rehospitalized** during the **first year** than are higher birth weight infants; **up to 60%** are rehospitalized at least once **by the time they reach school age**.*
- *Infants with BPD who are discharged home on **O2** are rehospitalized at **twice** the rate during the first 2 years of life compared to those who are not.*

# *Respiratory Syncytial Virus (RSV)*

- ***RSV** is the **most** important cause of respiratory infection in premature infants, particularly in those with chronic lung disease.*
- *VLBW infants should receive **prophylactic** treatment with **palivizumab** (Synagis) monoclonal antibody.*
- *AAP recommends treatment during RSV season for **at least the first year of life** for*
  - *infants **less than 32 weeks' gestation with BPD***
  - ***continued in the second year of life for those who have required diuretic or oxygen therapy***

# *RSV Prophylaxis*

- *The method of administering **Palivizumab** to all premature infants **under 2 years** of age from November to May is once **every 30 days** in the form of **intramuscular injection** at a dose of **15 kg/mg for 5 consecutive days**.*
- *The **influenza vaccine** is also recommended for **VLBW** infants once they are **older than 6 months chronologic age.***

# Air Travel

- *Air travel is not recommended for infants with **BPD** because of*
  - *the increased risk of exposure to infection*
  - *the lowered cabin pressure resulting in lower O2 content in the cabin air*
- *If an infant's partial pressure of oxygen (**PaO2**) is **≤80 mm Hg**, supplemental O2 will be needed while flying.*

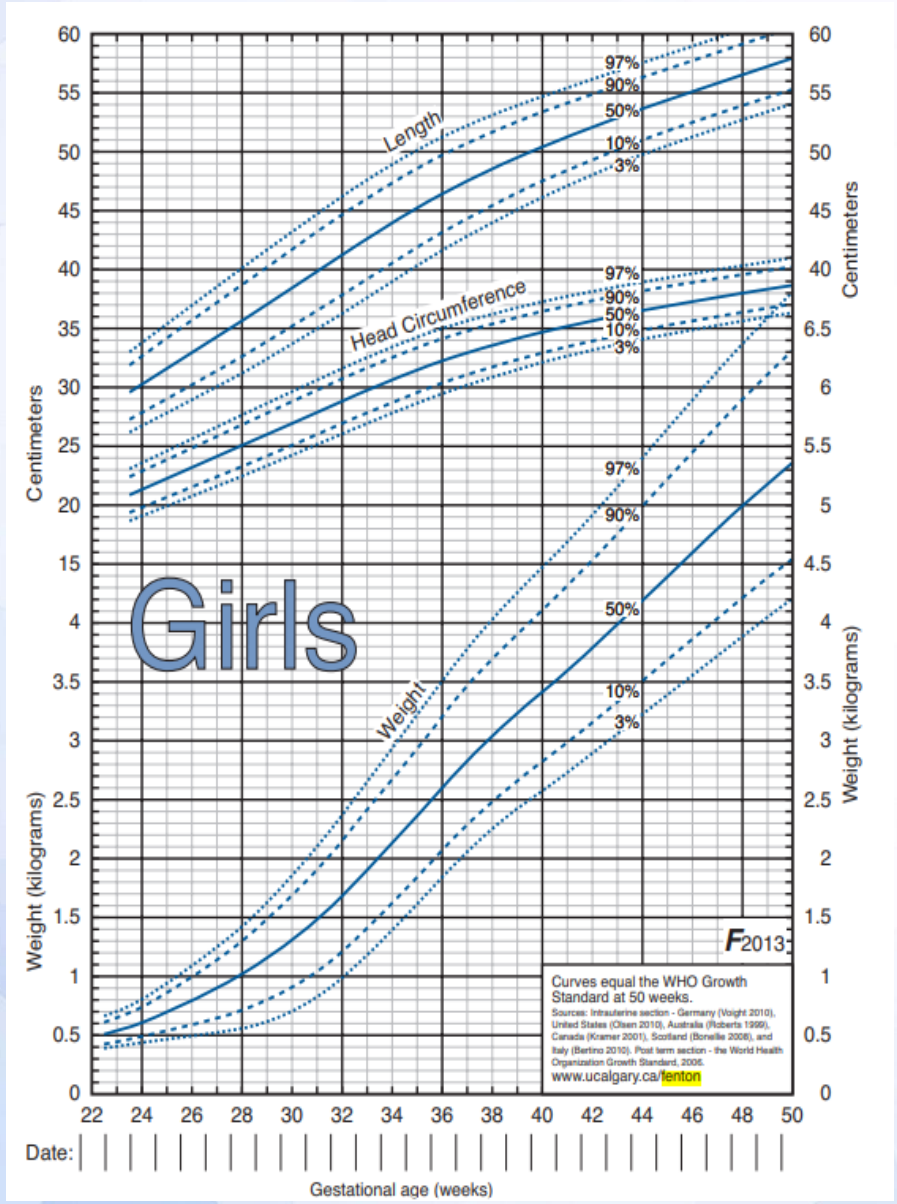
# Immunizations

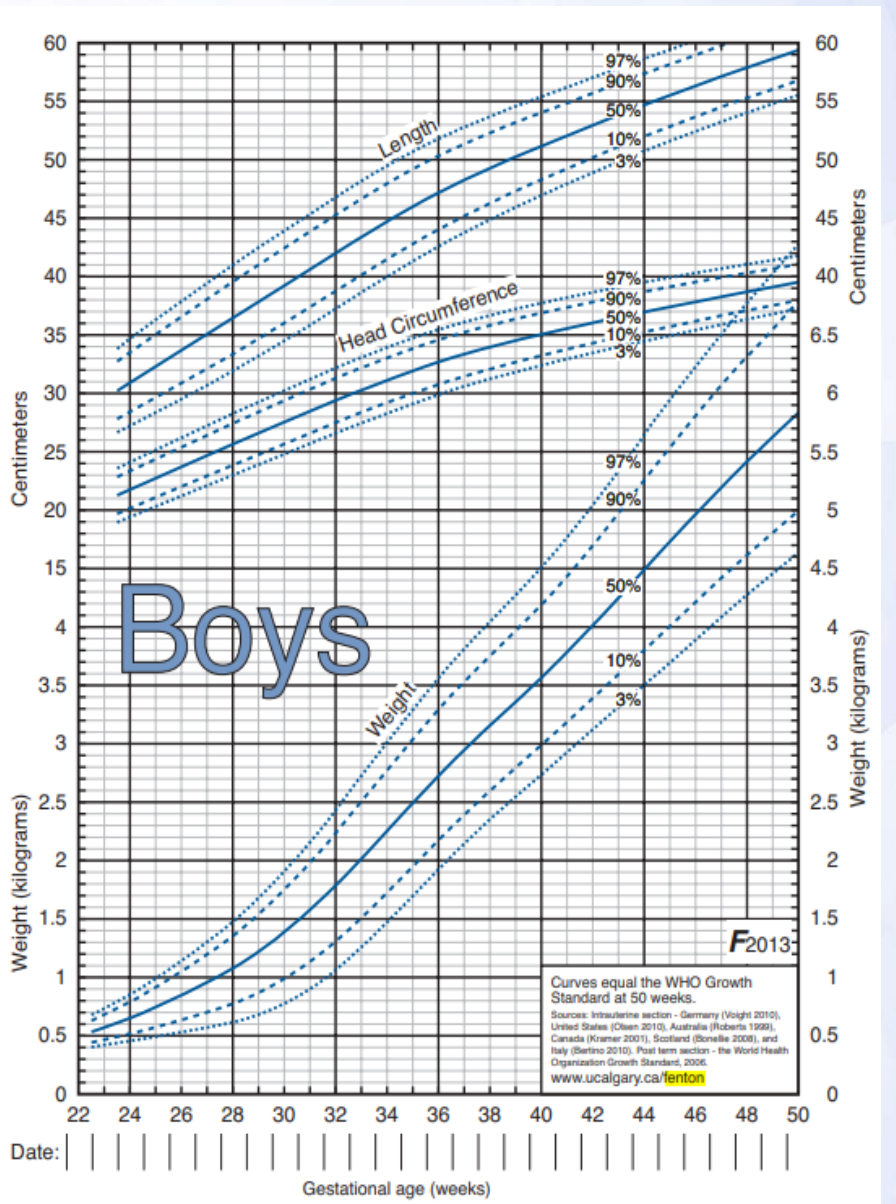
- ***VLBW** infants should receive their **routine pediatric immunizations**, with the exception of **rotavirus** and **hepatitis B** vaccine.*
- *The **AAP** recommends initial vaccination of preterm infants **at or following discharge** from the hospital if*
  - ***clinically stable** and*
  - ***chronologic age between 6 weeks and 14 weeks 6 days**.*
- ***Medically stable, thriving** VLBW infants should receive the **hepatitis B** vaccine as early as **30 days**.*
- *If the baby is ready for discharge to home before 30 days of age, it can be given **at the time of discharge to home**.*

# Growth

- *VLBW infants have a high incidence of **feeding** and **growth problems** for multiple reasons:*
  - ***Increased caloric needs** for appropriate weight gain (severe BPD )*
  - *Abnormal or **delayed oral motor development***
- *Growth should be followed carefully on standardized growth curves (WHO International Growth Curves 2006) using the **corrected gestational age** for **the first 2 years of life** and then using the Centers for Disease Control and Prevention (CDC) standardized curves.*
- *The Revised **Fenton** growth charts combine intrauterine growth with the WHO chart to construct a growth chart from **22 to 50 weeks' PMA.***

# Fenton Growth Chart



# Assessment Of Nutritional Status

- *Nutritional assessment is recommended for all infants with **gestational age ≤ 34 weeks** or **birth weight ≤ 1800 grams**.*
- *Values indicating impairment in nutritional assessments:*
  - *Weight gain **less than 15 to 20 g/kg/day for infants < 2 kg and 25 to 35 g/day for larger infants***
  - *Height increase less than **1 cm per week***
  - *Increase in head circumference less than **0.7 cm per week***
  - *Phosphorus **< 4 mg/dl***
  - *Alkaline phosphatase **> 900 IU/L***
  - *BUN **< 5 mg/dl***

# *Recommendations For Nutritional Impairment*

- *In case of the above disorders, the following are recommended:*
  - ***Control of feeding and breastfeeding***
  - *Use of* ***breast milk fortifiers***
  - *Use of* ***premature*** *or* ***post-discharge formula***
  - *Use of* ***nutritional supplements***
  - *Treatment of infants with* ***osteopenia of prematurity***
- ***Specialized preterm infant formulas*** *with increased protein, calcium, and phosphate (either added to human milk or used alone) should be considered for the* ***first 6 to 12 months*** *of life for infants who have borderline growth.*

# Recommendations For Nutritional Impairment

- *If growth failure persists, gastrointestinal pathology such as **severe gastroesophageal reflux disease** or endocrinologic problems such as **growth hormone deficiency** should be considered.*
- *Administering iron supplements in premature babies:*
  - *for **LBW** infants: **2-3 mg/kg** daily from 1 to 24 months old*
  - *For **VLBW** & **ELBW** infants: **3-4 mg/kg** daily from 1 to 24 months old*
- *Clinical evaluation and, if necessary, **screening** by measuring hemoglobin and hematocrit levels **before the age of 6 months***
- *For **iron deficiency anemia**, treatment with **ferrous sulfate** daily at the rate of **4-6 mg/kg** for **at least 3 months**.*

# *Hearing Follow-up*

- ***Hearing loss** occurs in approximately **2% to 11%** of VLBW infants.*
- *Prematurity increases the risk of both **sensorineural** and **conductive hearing loss**.*
- *All VLBW infants should be **screened** both in the **neonatal period** and again **before 1 year of age**.*
- *There is also evidence that VLBW infants are at increased risk for **auditory dyssynchrony** (also called **auditory neuropathy**) and **central auditory processing problems**.*

# *Audiometry In High-risk Infants*

- *Clinical conditions leading to hearing impairment in high-risk infants:*
  - *use of **ototoxic drugs** such as **aminoglycosides** and **furosemide***
  - ***Respiratory alkalosis***
  - ***Lack of noise control** in the NICU*
- *Recommended method to evaluate this group of infants:*
  - ***Automated Auditory Brain Stem Response (AABR)***

# *Screening and follow-up process for hypothyroidism in high-risk infants*

- *Check TSH at **3 to 5 days, 2, 4** and **6 weeks***
- *In the first month of birth, **T4 < 5.6** and **TSH > 5 mU/L** should be treated as primary hypothyroidism until 3-4 years of age.*
- *Levothyroxine dose: **10-15 mcg/kg** Max: 50 mcg/ day*
- *Follow up of treatment:*
  - ***2 weeks after the start of treatment***
  - ***Then monthly in the first 6 to 12 months of life***
  - ***Every 2 months for the next 12 months***
- *Ferrous sulfate and soy-based formula interfere with the absorption of levothyroxine*
- *It is recommended to give the medicine to the infant **2 hours before or after breastfeeding***

# *Follow-up Of Osteopenia Of Prematurity*

- ***Osteopenia*** *often appears a few weeks after birth, but the symptoms of* ***rickets*** *(epiphyseal dysplasia and skeletal deformation) usually appear in the* ***sixth*** *week of life.*
- *VLBW infants who have had nutritional deficits in calcium, phosphorous, or vitamin D intake are at increased risk for rickets.*
- *Etiology:*
  - ***Inadequate intake of minerals and reduced absorption after birth***
  - ***The use of Furosemide***
  - ***long-term use of corticosteroids***
  - ***TPN for a long time***
  - ***Renal excretion of phosphorus and vitamin D reduction***
- *Measurement of serum levels of calcium, phosphorus and alkaline phosphatase at* ***4-5 weeks*** *and at* ***3 and 6 months of age****.*

# *Diagnostic Criteria Of Osteopenia Of Prematurity*

- *Serum **phosphorus < 4 mg/dl** and **alkaline phosphatase > 800-1000 IU/L**. are helpful in diagnosing osteopenia. Serum calcium level can be normal, high or low.*
- *Treatment : start with 20 mg/kg of elemental calcium and 10-20 mg/kg of elemental phosphate and 400-1000 IU of vitamin D daily.*
  - *Max: 70-80 mg/ kg e-calcium and 40-50 mg/kg e-phosphorus.*
- ***Prevention** of metabolic bone disease:*
  - ***Supplementation of calcium and phosphorus** in premature babies weighing less than 1800 to 2000 grams (breastfed)*
  - *In cases of breast milk insufficiency, prescribing **premature infant formula** at the rate of 120 kcal/kg*

# *Dental problems*

- *VLBW infants are at increased risk for **enamel hypoplasia** and **discoloration**.*
- *Long-term intubation may result in **palate and alveolar ridge deformation** affecting tooth development.*
- *Initiation of routine **supplemental fluoride** at **6 months PMA** is recommended, as is referral to a pediatric dentist in the **first 12 months of life.***

# *Follow-up Of Nephrocalcinosis*

- *Factors related to kidney calcification include:*
  - ***Hypercalciuria** as the main pathophysiological factor, **hypophosphatemia**, **hypercalcemia**, long-term **oxygen** therapy, **male** gender, treatment with drugs such as **gentamicin**, **vancomycin**, **dexamethasone**, **Lasix** and **methylxanthines***
- *Nephrocalcinosis screening :*
  - *KUB ultrasound at **36 weeks** (corrected gestational age) or **1 month**; and **4 years old.***

# *Intraventricular Hemorrhage Follow-up*

- ***Predisposing factors*** *include:*
  - ***prematurity***, ***intrauterine growth restriction***, ***hypothyroxinemia***, ***hypercapnia****/hypercarbia,* ***hypothermia***, ***asphyxia****, placental or maternal* ***infection****, and increased cytokines.*
- *Most babies with IVH have no clinical symptoms.*
- ***Apnea***, ***pallor***, ***cyanosis***, ***poor sucking***, ***loud crying***, ***seizures***, ***hypotonicity***, ***metabolic acidosis****, and* ***shock*** *can be symptoms of IVH.*
- ***50%*** *occur on the* ***first day of birth*** *and* ***75%*** *of cases occur* ***between the first and third days.***
- ***PVL*** *is usually clinically asymptomatic until neurological complications and white matter damage appear as* ***spasticity*** *in the infant.*

# *Intraventricular Hemorrhage Follow-up*

- *The **ecodense phase** occurs on days **3 to 10** and the **cystic phase** on days **14 to 20**.*
- *Brain ultrasound should be performed in **ELBW** infants between **days 3 and 5** and in other **VLBW** infants at the **end of the first week** of life.*
- *Repeat brain ultrasound **2 to 3 times a week** (at least once a week).*
- *Follow-up of IVH should be done at **36 to 40 weeks** of corrected gestational age or at the **end of the first month** and before discharge.*
- *Cranial ultrasound is recommended in babies **older than 32 weeks** if there are risk factors such as **asphyxia**, **pneumothorax** or **neurological symptoms**.*

- ***When is the first screening program for retinopathy of prematurity in preterm babies between 23 and 26 weeks of gestational age?***

1. ***At 4 weeks of chronological age.***
2. ***At 30 weeks' PMA.***
3. ***At 31 weeks' PMA.***
4. ***At 32 weeks' PMA.***

# *Follow-up Of Retinopathy Of Prematurity*

- ***AAP** clinical guideline recommendations for ROP **screening**:*
  - ***All babies with a gestational age < 30 weeks or***
  - ***Birth weight < 1500 grams***
  - *Babies with a gestational age > 30 weeks or a weight of 1500 to 2000 grams if they have an **unstable clinical condition***
- *Problems causing clinical instability:*
  - *perinatal **asphyxia**, prolonged **hypoxia**, severe **acidosis**, severe **hypoglycemia** or **hypotension** requiring **vasopressor** drugs, **IVH**,* **BPD**, repeated **apnea** *,….*

# *Follow-up Of Retinopathy Of Prematurity*

- *The time of the first eye examination:*
  - *In infants with a **gestational age ≤ 27 weeks →** at the age of **31 weeks' PMA***
  - *In infants with a **gestational age > 27 weeks→4 to 5 weeks after birth***
- *Eye examination can be done with or without anesthesia.*
- *If anesthesia is required, examinations should be performed in a hospital with a neonatal intensive care unit.*
- *Examination without anesthesia can be done at the bedside or in a clinic equipped with newborn monitoring and resuscitation facilities.*
- *Eye exams are usually continues **every 1 to 2 weeks** until the baby is **at least 38 to 40 weeks' PMA**.*

# *Treatment Of Retinopathy Of Prematurity*

- ***Laser therapy*** *to ablate the entire peripheral avascular retina (****the standard treatment****)*
- ***Intravitreal injection of anti-endothelial growth factor*** *mainly* ***bevacizumab*** *(****Avastin****)*

# *Other Ophthalmologic Problems*

- ***Refractive errors*** *(**Myopia** is the **most common** problem and may be severe)*
- ***Amblyopia*** *(can become permanent if it is not treated before 6 to 10 years of age)*
- ***Strabismus*** *(especially in those with a history of ROP, intracranial hemorrhage, or white matter injury)*
- *In infants who have had severe ROP including those treated with laser therapy, there is an increased risk of **cataracts**, **glaucoma**, **late retinal detachment**, **abnormal color vision development**, and **visual field deficits.***

- *Close monitoring until the **retinal vessels** have reached **maturity** (in the **first months of life**)*
- *Subsequent assessments (by **8 to 12 months** of age then **annually** or **at 3 years of age**)*

# جدول زمانبندي مراقبتهای پیگیری شیرخوار پرخطر

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THANK YOU!