

GROWTH RESTRICTION IN THE LATE PRETERM INFANT

Babies who have not been able to grow to their fullest growth potential in utero have *intrauterine growth restriction (IUGR)*. If a baby's growth rate starts to decrease during the 1st or 2nd trimester (i.e., before 26 weeks' gestation), the infant typically will have a small head and body size. Because this baby is small throughout their entire body, this type of growth restriction is termed *symmetric IUGR*. If a baby's growth rate starts to decrease in the 3rd trimester (i.e., after 26 weeks' gestation), the infant's head will have grown appropriately while the baby's body size will be small. Because the infant's head size appears disproportionately larger compared with the infant's body size, this type of growth restriction is known as *asymmetric IUGR*, also known as head-sparing IUGR. Asymmetric IUGR is more common than symmetric IUGR.

Obstetricians may purposely deliver a growth-restricted infant early if the fetal growth slows down severely. Despite their smaller size, growth-restricted infants achieve maturity based on their gestational age. For example, an infant born at 34½ weeks' gestation weighing only 2 pounds 12 ounces (1250 grams) will have a similar maturity level as a well-grown infant born at 34½ weeks' gestation and weighing 4 pounds 15 ounces (2250 grams). However, because of their small size, growth-restricted infants often have medical issues that require closer and longer

observation in the hospital. Indeed, many infants need to be admitted to the SCN/NICU for treatment. Families can be more prepared by anticipating these possible medical issues.

Causes of Growth Restriction

There are many different factors that can cause a baby to have poor growth in utero. These factors can be divided into 3 categories, those that relate to the mother, the fetus, or the placenta. Many of these factors overlap, often making it difficult to determine the precise cause of the IUGR. In a large number of cases, the reason for the infant's growth restriction in utero is not known.

Maternal causes that can lead to IUGR typically involve an illness in the mother that limit the function of the placenta. For example, a pregnant woman with high blood pressure; diabetes; heart, lung, or kidney disease; or an increased blood clotting tendency is more likely to have a placenta that does not function efficiently and so, provides fewer nutrients to the fetus. If the uterine space is small, perhaps because of a mass, such as a fibroid, the growth of the fetus may be limited. None of these causes of IUGR result from anything that the mother did wrong and thus, these causes of growth restriction are not usually preventable. In underdeveloped countries, chronic severe malnutrition of a pregnant woman may lead to IUGR. There are some preventable causes of IUGR, such as maternal exposure to excessive amounts of toxins (e.g., tobacco, alcohol, or illicit drugs).

There are also a number of causes of growth restriction related to the fetus. If the pregnancy results in a twin or triplet gestation, the

fetuses may not grow as well because of limited space within the mother's uterus. If a fetus has a genetic abnormality or develops a severe infection during the 1st or 2nd trimester, fetal growth may be inadequate.

In the United States, a poorly functioning placenta is the most common cause of IUGR. This can be caused by maternal factors, listed above, or because of issues within the placenta itself. The placenta may be small or inadequately implanted into the uterus, causing it to work less efficiently.

Medical Issues of Growth-Restricted Infants

After birth, a growth-restricted infant often needs additional time in the hospital for observation and treatment compared with a baby of similar gestational age. Growth-restricted infants may need help with:

- Maintaining their temperature,
- Keeping a normal blood glucose concentration,
- Keeping a normal platelet count, and
- Transitioning from a fetal blood circulation to a postnatal circulation.

Growth-restricted infants have a low amount of fat on their bodies and may have difficulty staying warm (see Temperature Control Chapter). Similar to all late preterm infants, nurses will closely monitor a growth-restricted infant's temperature soon after birth and throughout the infant's hospital stay. Growth-restricted late preterm infants are more likely to need extra clothing to stay warm compared with appropriately grown late preterm infants. Infants

weighing less than 4 pounds (less than 1800 grams) often need to be placed in an incubator to stay warm. Babies need to have a normal temperature in an open crib for a period of time before they are discharged to home.

Growth-restricted babies have a lower amount of carbohydrate stores so they have more difficulty maintaining a normal concentration of *glucose*, a specific type of sugar, in their bloodstream. Because of this risk of low glucose, called *hypoglycemia*, a nurse will check a growth-restricted infant's blood glucose concentration several times in the first days of life. If all of the infant's sugar concentrations are normal, the infant's feeding plan can remain the same and the infant's glucose concentrations no longer need to be monitored.

However, if the glucose concentrations checked in the first day of life are low, additional support is necessary (see Feeding Chapter).

These options include:

- Supplementing with pumped breast milk or formula,
- Adding extra calories to the pumped breast milk or formula, or
- Administering an intravenous solution containing glucose into the infant's bloodstream.

For example, if an infant is exclusively breastfeeding and the infant's glucose concentration is low, the infant needs to be given pumped breast milk or formula. If a baby drinks an appropriate amount of formula/pumped breast milk but the glucose concentration still remains low, the pumped breast milk or formula can be supplemented with extra calories.

If a baby is unable to drink enough breast milk/formula to establish a normal glucose concentration, a fluid containing glucose can be given into the infant's IV. This requires placement of a catheter into a vein in the infant's hand, arm, foot, leg, scalp or umbilical cord. If an infant requires this intravenous fluid for more than a day, electrolytes, fats, carbohydrates, and protein can be added to the glucose water. If the infant remains unable to feed an adequate amount by mouth, a temporary feeding tube may need to be placed (see Feeding Chapter).

Once an infant's glucose concentration is stable, these additional supports are removed one at a time if the glucose concentration continues to remain normal. For example, if a growth-restricted infant has required intravenous glucose fluid to maintain a normal glucose concentration, this fluid will be decreased slowly. If the infant's blood glucose concentrations remain normal, the intravenous fluid will then be discontinued.

While some growth-restricted infants never require additional glucose support, others may need both extra support and frequent testing of blood glucose concentrations for days to weeks.

Sometimes babies with severe growth restriction may have other blood tests while in the hospital. Some babies can have a low white blood cell count (called *leukopenia*) or a low platelet count (called *thrombocytopenia*) after birth. While an infant's low white blood cell count will usually increase over time without any treatment, some babies with a low platelet count may require a platelet transfusion during the first week of life. If an infant's platelet count

is very low, the infant may be at increased risk for bleeding and the baby's doctor may order an ultrasound of the infant's head (called a *head ultrasound*). In this study, a radiology technician will place an ultrasound probe over the soft spot on top of the baby's head. A radiologist will then review the images to determine if the baby had any bleeding in the fluid chambers near the infant's brain or in the brain tissue.

Growth-restricted infants may also be born with a higher red blood cell count, known as *polycythemia*. This may cause the baby's skin to appear redder. When the extra red blood cells break down, this can lead to a higher amount of bilirubin produced in their blood. These infants may then need phototherapy treatment for jaundice (see Jaundice Chapter). A small number of infants with polycythemia may have so many extra red blood cells, that they develop symptoms, such as needing extra oxygen or having low blood sugar concentrations. If this happens, these infants may require treatment to dilute their blood. In this procedure, extra fluid is given into an infant's IV while some of the baby's blood is removed. This procedure is known as a *partial exchange transfusion* because some of the infant's blood is being exchanged for fluid. With or without treatment, once a baby's red blood cell count returns to normal, polycythemia is unlikely to occur again.

Growth-restricted infants may take longer to transition from the circulation of a fetus to the circulation of the newborn. This is called *persistence of the fetal circulation* (also known as pulmonary hypertension) and leads to decreased blood flow to the infant's lungs. Affected infants may require extra oxygen or breathing support. Babies who have persistence of the fetal

circulation will typically have symptoms in the first few hours of life and may require several days or weeks to transition to the newborn circulation.

Healthcare providers will check the thyroid hormone concentration of growth-restricted infants tested on the newborn state screen (see Transition to Home chapter) because growth-restricted infants can have low amounts of thyroid hormone.

Growth-restricted infants with a birth weight less than 1500 grams (= 3 pounds 5 ounces) will require an eye examination by an ophthalmologist to follow the growth of the blood vessels in the infant's retina. The first eye examination may show immature blood vessels. In this case, the infant requires follow-up examinations until the blood vessels are mature. A small number of growth-restricted infants will have slightly irregular blood vessel growth in the retina, called *retinopathy of prematurity*, which requires closer follow-up. In most cases, the retinopathy of prematurity identified in growth-restricted late preterm infants will resolve without treatment. Follow-up examinations to monitor abnormal or immature blood vessel growth may sometimes be done in the hospital but those babies who are discharged home will need an outpatient ophthalmology appointment soon after discharge.

Long-term Monitoring

After a growth-restricted infant leaves the hospital, the pediatric care provider will continue to monitor the infant's growth. Some infants may need extra calories added to pumped breast milk or

formula. Current studies suggest, however, that IUGR infants should not grow too quickly in the first year of life. Thus, the pediatric care provider will follow the infant's growth closely to make sure that the infant gains weight appropriately, but not excessively.

In general, it is difficult to predict whether an infant's growth restriction in utero will impact his/her long-term neurological function. Long-term outcomes of growth-restricted infants often correspond with the degree of the growth restriction: the smaller the baby, the greater the concern for possible neurological issues. The earlier in the pregnancy that fetal growth has slowed, the greater the risk. Thus, infants with asymmetric growth restriction are at lower risk of long-term problems than babies with symmetric growth restriction. A child's outcomes are also partly dependent on the underlying cause of the growth restriction. For example, a growth-restricted baby with a chromosomal abnormality, such as trisomy 21 (also known as Down syndrome), is likely to have a greater number of learning issues than an infant with a non-genetic cause of growth restriction.

Because a growth-restricted infant's long-term prognosis is not predictable, it is important that the infant's pediatric care provider closely monitors the baby's development and assesses for behavioral and learning difficulties. Many states offer Early Intervention Services for growth-restricted babies. This program provides close monitoring by an occupational therapist, physical therapist, developmental educator, feeding therapist, and speech specialist until the child is 3 years of age. Those babies with poor

head growth or developmental delays are at particular high risk for difficulties and often require more support.

Conclusion

Growth-restricted infants require closer observation and monitoring after they are born. Some infants may need to be admitted to the SCN/NICU for a few days to several weeks for the following possible problems:

- Need for extra support to remain warm,
- Low blood sugar concentrations that require additional support with expressed breast milk, formula, extra calories, or intravenous glucose fluid,
- Low concentration of platelets, and
- An increased amount of red blood cells.

While these issues typically resolve prior to going home, growth-restricted infants may have developmental issues. Thus, the infant's pediatric care provider needs to continue to closely monitor the infant's developmental progress and assess for behavioral and learning difficulties.