PedsCases Podcast Scripts

This is a text version of a podcast from Pedscases.com on "**LGA/IDM.**" These podcasts are designed to give medical students an overview of key topics in pediatrics. The audio versions are accessible on iTunes or at www.pedcases.com/podcasts.

LGA/IDM

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Introduction:

Hi everyone, my name is Manisha Tilak, and I am a medical student at Queen's University. This podcast was developed with Dr. Robert Connelly, a neonatologist and Head of the Department of Pediatrics at Queen's University. Today's podcast focuses on the management of babies who are born to diabetic mothers, and who may be large for gestational age, or, "LGA". Let's start by defining our learning objectives.

Learning Objectives:

1. Define the term "large for gestational age", and learn how this relates to infants born to diabetic mothers
2. Describe how maternal diabetes affects the developing fetus before conception and during pregnancy
3. Describe the appropriate screening and treatment of pregnant women with diabetes
4. Describe the complications that LGA infants can experience during labour and delivery
5. Describe the appropriate postnatal assessment and care of the LGA newborn after birth

Clinical Case

Let's start with a clinical case. You are a medical student working with the NICU team when you are called to attend a delivery. The mother is a 37 year old gravida 2 para 1 with a pre-pregnancy BMI of 25. She was diagnosed with gestational diabetes during pregnancy, and the fetus has been measured to weigh in at the 95th percentile on antenatal ultrasound. She was admitted to labour and delivery yesterday morning for an induction of labour at 38 weeks gestation. After a long, protracted labour, the baby is born and is rapidly handed off to you and the waiting NICU team. What are your immediate and long-term management plans for this newborn? What do you expect to find on physical exam? We'll come back to this case and answer these questions as we go through the podcast.

What does it mean to be large for gestational age?

So, what does it mean for a baby to be large for gestational age, or, LGA? Newborn babies are all classified at birth according to their birth weight and their gestational age. Babies are considered to be a "normal" weight if their weight falls between the 10th and 90th percentile when compared to all other babies of the same gestational age. This can be determined very

quickly by looking at a standard fetal growth chart. If a baby weighs in above the 90th percentile, that baby is classified as LGA. For a term baby at 40 weeks gestation, this would be greater than 4 kg or 8 lb and 13 oz. Macrosomia is a related term which is applied to all babies which are greater than 4 kg regardless of gestational age. By these definitions, essentially all babies with macrosomia are LGA, however some LGA babies at earlier gestational ages will not meet the definition for macrosomia.

There are a number of reasons that a baby can be large for gestational age. One of the main risk factors for a baby to be LGA is being born to a mother with diabetes. This is caused by excessive maternal glucose crossing the placenta. However it is important to realize that not all LGA babies are born to diabetic mothers, and that not all diabetic mothers will deliver babies who are LGA. Some families simply have a genetic tendency towards having big babies. There are a number of genetic syndromes that can lead to LGA, the most common of which is probably Beckwith-Wiedemann syndrome. Maternal obesity or excessive maternal weight can also lead to LGA infants.

Why do we care about diabetes in pregnancy?

Pregnant women with diabetes can be thought of in two broad categories: women with pre-existing diabetes, or women who develop diabetes during pregnancy. It may not seem like there would be much difference between these two types of women, however they do differ in terms of their management during pregnancy and the outcomes for their newborns.

Women with pre-existing diabetes should ideally be counselled on strict glycemic control before getting pregnant. High maternal blood glucose levels at conception put the developing fetus at a greater risk of congenital anomalies such as cardiac defects, neural tube defects, or limb and facial anomalies. These women should therefore be prescribed a high-dose folic acid supplement before becoming pregnant in order to minimize the risk of neural tube defects in the fetus. They should also be offered serum screening tests and ultrasounds early in the pregnancy to evaluate the fetus for cardiac defects or other congenital anomalies.

Gestational diabetes, or GDM, is the term used to describe expectant mothers who develop high blood glucose levels during pregnancy. While we can never predict exactly which women will develop this condition, there are certain risk factors that make GDM more likely. These include age over 35, BMI over 30, previous GDM, family history of diabetes, and Asian, Hispanic, Indigenous, African, or South Asian ethnicity. Women with GDM do not have the same risks for fetal congenital anomalies as women with pre-existing diabetes, however they are at a greater risk of preeclampsia, shoulder dystocia, cesarean section, and stillbirth during labour and delivery. These complications can be minimized by closely following the woman's pregnancy, and planning for induction of labour around 38 to 40 weeks' gestation.

How are women screened for GDM?

So how do we identify women with gestational diabetes? All pregnant women should be screened for GDM at 24 to 28 weeks gestation, with screening being offered earlier in the pregnancy to women with multiple risk factors. The most common screening test used to detect GDM is a 50g glucose challenge test. This test involves drinking a sugar syrup containing 50g of glucose, and then measuring blood glucose levels one hour later. Patients do not need to be fasting before doing this screening test. If the blood glucose level comes back below 7.8 mmol/L, the patient does not have gestational diabetes, and no further testing is required. If the

blood glucose level comes back above 7.8 mmol/L, patients will need to have a diagnostic test performed to confirm whether or not they have gestational diabetes.

The diagnostic test of choice for GDM is a 75 gram oral glucose tolerance test, which is performed after the patient has fasted for at least 8 hours. Blood glucose levels are measured after the 8 hour fast, and the patient then drinks a similar sugar syrup containing 75g of sugar. Blood glucose levels are then measured 1 and 2 hours later. If the patient's fasting blood glucose level is over 5.3mmol/L, over 10.6mmol/L after 1 hour, or over 9.0mmol/L after 2 hours, the patient is diagnosed as having gestational diabetes.

Treatment of diabetes in pregnancy/monitoring the fetus

Once a pregnant woman has been identified as having diabetes, strict glycemic control should be emphasized in order to improve maternal and fetal outcomes. All pregnant women should be counselled on maintaining a healthy diet and exercising regularly, regardless of whether she has pre-existing diabetes or GDM. If lifestyle modifications alone are not enough to achieve adequate glucose control, regular subcutaneous insulin administration may be required.

Pregnant women with diabetes should also be monitored closely for both maternal and fetal complications during pregnancy. Antenatal ultrasound scans should be performed every 2-4 weeks starting at 28 weeks gestation, in order to monitor fetal growth and amniotic fluid volume. It is very important to identify whether a fetus is small or large for gestational age prenatally, as this will guide the management plan for the newborn during labour and after birth.

Back to our Case:

You review the mother's chart to learn more about the pregnancy and the baby's course in utero. You discover that the mother was completely healthy before becoming pregnant, and had normal screening tests and anatomy ultrasound scans. At 28 weeks gestation she had a blood glucose level of 8.9mmol/L one hour after her glucose challenge test which is above the screening cut-off of 7.8 mmol/L. She then had a blood glucose level of 11.4mmol/L one hour after her 75 gram oral glucose tolerance test, which is above the diagnostic cut-off of 10.6 mmol/L. This confirmed the diagnosis of gestational diabetes and she was started on insulin at 32 weeks gestation. You then start to wonder, what are the consequences of maternal diabetes for a newborn baby, and how are they handled after birth?

Fetal/Neonatal outcomes of gestational diabetes

It is important to screen for gestational diabetes during pregnancy because of the potential harms it can cause to the baby during labour and delivery and after birth. Babies born to mothers with GDM are more likely to be large for gestational age due to increased maternal glucose crossing the placenta, causing increased fetal adipose tissue deposition. These infants are therefore at an increased risk of injuries during labour due to their large size as compared to the maternal pelvic outlet. The most important birth injury to be aware of is a brachial plexus injury, which can occur if the fetus's shoulder gets caught behind the maternal pubic bone during birth. This can cause either short-term or long-term damage to the nerves of the brachial plexus, leading to a flaccid paralysis in the affected arm. This is called an Erb's palsy. In most cases the injury to the brachial plexus is only temporary, and the infant will regain full function of the arm. However in some cases, this type of birth injury will lead to permanent nerve damage.

There are also a variety of metabolic consequences to LGA infants. Exposure to high maternal glucose levels in utero not only leads to increased prenatal adipose tissue development, but

also causes the fetal pancreas to produce increased amounts of insulin to lower fetal blood glucose levels. This is not a problem for the fetus in utero when there is lots of glucose floating around, however after birth the baby is cut off from the maternal glucose supply and these high levels of insulin persist. The end result is hypoglycemia in the newborn. Therefore infants of diabetic mothers should be screened for hypoglycemia after birth and treated until their insulin and blood glucose levels normalize. For more information on this topic, check out our PedsCases podcast on Neonatal Hypoglycemia.

Hyperinsulinemia not only leads to hypoglycemia in the newborn, but can also increase the risk for newborn respiratory distress. All infants require surfactant in their lungs in order for the alveoli to expand adequately. In a normal newborn, surfactant release is stimulated by circulating glucocorticoids. However in the LGA infant, hyperinsulinemia suppresses glucocorticoid release, which in turn leads to decreased surfactant release. This can lead to newborn respiratory distress syndrome.

LGA infants are also often polycythemic due to their increased size. This means that the infant's red blood cell volume is increased as compared to a normal sized newborn. It is still not clear why this occurs, however it's thought that the infant develops polycythemia due to increased level of erythropoietin stimulating red blood cell production.

An important consequence of polycythemia to be aware of in LGA infants is hyperbilirubinemia, also known as "jaundice". Jaundice refers to the buildup of excess bilirubin in the bloodstream, causing the infant's skin and sclera to take on a yellow appearance. This can occur for many reasons, however the most common reason for jaundice in an LGA infant is increased red blood cell breakdown releasing more bilirubin into the bloodstream.

Jaundice is important to identify in all newborns due to the potential for brain damage caused by excess bilirubin deposition in the brain; this condition is called *kernicterus*. Kernicterus occurs because the infant's blood brain barrier is leakier than that of an adult, allowing more bilirubin to cross over and form deposits causing brain damage. The main treatment for jaundice is called phototherapy, where the infant is placed under blue UV lights to help increase bilirubin excretion. If the bilirubin levels are extremely high phototherapy may not be enough to cause an adequate decrease in bilirubin levels; exchange transfusion may then be required. For more information you can check out our podcast series on neonatal jaundice.

Back to our Case

After delivery, you work with the NICU team to stabilize the baby. The baby is large, weighing over 4 kilograms. There is mild respiratory distress at birth which resolves with positive pressure ventilation, so you transfer the baby to the NICU for monitoring. You notice that the baby is quite red, and find that their total serum bilirubin level is quite high. The baby is also found to be hypoglycemic with a blood glucose level of 2.1mmol/L. The baby is therefore treated with phototherapy for 24 hours and glucose administration to correct the hypoglycemia. The bilirubin and glucose levels normalize within a few days, and the baby is ready to be discharged home with his parents on the 7th day of life.

Before we conclude this PedsCases podcast, let's go over some key points to remember:

1) Infants who are born weighing in above the 90th percentile are described as being large for gestational age. These infants are often born to mothers with GDM.
2) The effects of pre-existing and gestational diabetes on a growing fetus are different. Infants born to women with pre-existing diabetes are more likely to be born with

congenital anomalies, whereas infants born to women with gestational diabetes are more likely to be LGA.

3) The LGA infant is at a higher risk of birth injury during labour and delivery; the most common injury to occur in LGA infants is a brachial plexus injury, or Erb's palsy.
4) Common complications of maternal diabetes in the neonatal period include hypoglycemia, polycythemia, hyperbilirubinemia, and respiratory distress.

This concludes our podcast on large for gestational age infants and infants of diabetic mothers. We hope you enjoyed listening, and learned something new about the pre-natal and post-natal aspects of caring for women with diabetes and their newborns. Thank you.

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