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Approach to Prematurity – Part I An Overview of Prematurity

Developed by Jhanahan Sriranjana and Dr. Kristin Inch for PedsCases.com.

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Introduction

Welcome to Approach to Prematurity, Part 1: An Overview of Prematurity - created for PedsCases.com. My name is Jhanahan Sriranjana and I am a medical student at the Michael G. DeGroot School of Medicine at McMaster University. This is a two-part video that aims to provide the learner an overview of prematurity, considerations surrounding stabilization of preterm infants, and finally a systems-based approach to common conditions associated with prematurity. This podcast would not be possible without the kindness and support of Dr. Kristin Inch, a pediatrician practicing at the Special Care Nursery at St. Joseph's Hospital in Hamilton Ontario.

Learning Objectives

By the end of part I, we hope that the learner will be able to:

- Define prematurity and review its epidemiology in Canada.
- Describe major risk factors for pre-term birth.
- Compare the different characteristics of extremely preterm, very preterm, and infants born at term.

In Part two, we will:

- Outline the considerations for initial stabilization of a premature infant.
- And describe a systems-based approach to recognizing and managing common short-term complications associated with prematurity.

Throughout this presentation, we will be following 4 infants and their families, which will help the learner to identify key differences in children at various stages of pre-term development.

Objective #1 – What is Prematurity?

Let's begin with our first objective. Historically, prematurity was defined as a birth weight lower than 2500g. However, it is now defined by the World Health Organization

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as babies born alive before **37 weeks gestation** from the **Last Menstrual Period**, or **LMP**¹.

The LMP refers to the first day of an expecting mother's last menses. It can be used to calculate the **estimated due date (EDD)** using **Naegele's Rule**, which is the LMP + 7 days minus 3 months².

It is important to note however that according to the American College of Obstetricians & Gynecologists, determining gestational age should be based on the best **obstetric estimate**, rather than the LMP alone. This primarily involves the **First Trimester Ultrasound**³.

Objective #1 – How common is prematurity in Canada?

Preterm birth is the leading cause of morbidity and mortality in children younger than 5 years around the world⁴. In Canada, preterm birth occurs in about 8% of total pregnancies. Preterm birth accounts for nearly two thirds of infant deaths in Canada, as well as increased morbidity later in the life course, as demonstrated by increased rates of adult-onset chronic disease⁵.

There are slightly more male preterm births than female preterm births, with 8.3% of male births being preterm compared to 7.3% of female births being preterm⁶.

Preterm birth is much more common in multiple pregnancies compared to single births. Additionally, preterm births are most prevalent among mothers aged 35 to 49 years of age⁶.

Introducing our Cases!

And now, to introduce our cases!

While on your pediatrics rotation, you are called down to evaluate 3 expecting mothers who have presented to L&D.

Our first mother is Mrs. Amy Austin. Amy is 24 years old and is 38 weeks pregnant. She is expecting her first child, whom her second trimester ultrasound presumes to be male. Amy is not currently on any medications but has a history of recurrent UTIs that have generally resolved on their own. Before she was pregnant, Amy would sometimes enjoy a drink or two with dinner 3x a week, and has a 3-pack year history of smoking, although she has significantly cut down on smoking since finding out she was pregnant, and does not drink anymore at all.

Our second mother is Mrs. Briyanka Balakrishnan. Briyanka is 38 years old and is 28 weeks pregnant. She is expecting her second child, whom the ultrasound presumes to be female. Briyanka had her first child when she was 29, who was born prematurely at 32 weeks gestational age. Briyanka has a history of hypertension, for which she is being treated with labetalol. Briyanka does not smoke or drink, and never has.

Finally, we have Ms. Catherine Chang. Catherine is 27 years old and is 35 weeks pregnant. She is expecting twins (one male and one female)! This is Catherine's first pregnancy. In the past, Catherine has been told by her gynecologist that she has something called a "bicornuate uterus". Catherine is otherwise healthy and does not drink or smoke.

Let's look at some of the possible risk factors for pre-term birth among these 3 expecting mothers.

Objective #2 – Major Risk Factors for Pre-Term Birth

Spontaneous pre-term birth is multi-factorial, meaning it can be caused by all sorts of genetic, epigenetic, social, and environmental factors!

It is important to note that many preterm spontaneous births are **idiopathic** – 2/3 of preterm births occur in women without ANY risk factors! However, there are also some known causes that can contribute to preterm delivery. In general, we can think of these causes as belonging to one of three categories:

The first category is **maternal factors**. Some examples include **age**, **previous history of preterm birth**, and **medical conditions**. In general, expecting mothers under 17 or over 35 are more likely to have preterm deliveries. Mothers who have had a preterm delivery in the past, like in our case with Briyanka, are also more likely to have a future preterm delivery, usually at the same gestational age! Finally, some medical conditions that are associated with preterm delivery include pre-eclampsia, hypertension, infections (i.e. UTIs, GBS, and HIV), chronic diseases, nutritional status, use of smoking and recreational drugs.

The second category are **placental/uterine factors**. These refer to changes or abnormalities of the uterus and placenta that predispose infants to pre-term birth. One example is significant **intrauterine stretch**, which can be caused by multiple gestation, polyhydramnios (excessive fluid in the amniotic sac), or uterine abnormalities such as bicornuate uterus, as we saw in our case with Catherine! Another example is **intrauterine infection**, such as chorioamnionitis, bacterial vaginosis, and premature rupture of membranes (PROM). Finally, any **intrauterine bleeding** (for example due to placental abruption or antepartum hemorrhage) can also lead to preterm delivery.

The final category are **fetal factors**. These refer to congenital, or growth-related factors of the fetus themselves that may lead to preterm birth. Congenital causes primarily refer to central nervous system defects but may also include orofacial or musculoskeletal defects. Another fetal factor may be intrauterine growth restriction (IUGR). Lastly, fetal distress, which is typically caused by oxygen deprivation of some etiology, can lead to preterm birth. Fetal distress may have spontaneous or iatrogenic causes.

Counselling & Management Considerations for Anticipated Extremely Preterm Birth

So, knowing some of the factors that may contribute to preterm delivery, the Canadian Pediatric Society has some important counselling and management considerations for anticipated extremely preterm birth⁷.

First, it is crucial to **assess gestational age!** Establishing an accurate GA using 1st trimester crown-rump length, is crucial for counselling, management, and support of the family as they prepare for their little one.

Transferring women at risk for extremely preterm birth to **tertiary perinatal centres** improves maternal care and provides better opportunities for counselling with MFM specialists and neonatologists. If a transfer is not possible, decisions surrounding management must consider availability of resources and possible limitations of the current setting, as well as use local expertise where possible.

Importantly, the use of **antenatal corticosteroids** has been shown to improve survival rates and decrease the risk of RDS, BP, IVH, and NEC (more on those later) in extremely pre-term infants. Antenatal corticosteroids are given to women at risk of preterm birth between 22-34 weeks GA and have maximal efficacy within 7 days of last dose. Additionally, **magnesium sulfate** is also given between 22-34 weeks, as it can reduce the risks of cerebral palsy rates.

In terms of delivery, CPS also states that there is currently no evidence that routine c-sections improve neonatal outcomes.

Finally, it is crucial that parents facing the birth of an extremely preterm infant should have several opportunities to meet with healthcare providers to create a care plan, which should involve a shared-decision-making approach.

Objective #3 – Comparing Term, VPT, and EPT Infants

Let's move onto objective #3.

Preterm Birth can be further classified into 4 different gestational age ranges, including **Late Preterm, Moderate Preterm, Very Preterm (VPT), and Extreme Preterm (EPT)**⁸.

Late preterm infants are born between 34 and 37 weeks gestational age. Moderate preterm infants are born between 32 to 34 weeks, very preterm infants are born between 28-32 weeks, and extreme preterm infants are born at a gestational age less than 28 weeks.

Premature infants vary considerably from term infants in size, appearance, and development. For example, while the average birthweight of a term infant is 3500g, a VPT infant weighs about 1.5kg on average, and an EPT infant weighs 0.7kg on average. Other characteristics that vary include, skin, genitalia, posture, vision, hearing, breathing, sucking/swallowing, and their sleep/wake cycle.

Term infants often have thick skin and appear pale pink. Genitalia are developed, and movements are flexed and smooth. Term infants may look at faces and follow curvy lines and may turn their head and eyes to sound. Term infants can cry when hungry and can coordinate breathing and sucking/swallowing. They also typically have defined sleeping/waking states.

VPT infants may have medium-thickness skin. In males, their testes are typically not descended and in females, the labia minora and clitoris are only partially covered. VPT

infants may have some leg flexion, and vision/hearing is somewhat limited. These infants may require respiratory support or have apnea and may require nasogastric feeding or TPN.

EPT infants often have thin, gelatinous skin and appear dark red all over their body. In males, their testes are impalpable, and their scrotum is smooth. In females, the clitoris is prominent and the labia majora are widely separated. Their movements are often extended, jerky, and uncoordinated. EPT infants may have fused or only partially open eyelids, with absent or infrequent movements. They often startle to loud noises. EPT infants also often require respiratory support and usually require TPN. They do not have a defined sleep cycle and are often in an intermediate sleep state.

The Ballard Score

A useful tool on the wards is the Ballard Score. When completing a newborn exam, clinicians can roughly estimate a neonate's gestational age using this tool. The Ballard Score is based on the neonate's physical and neuromuscular maturity and is often used within first 24 hours of life. It is accurate within +/- 2 weeks⁸.

Learning Objectives

So, by now we have been able to define prematurity, evaluate risk factors for preterm birth, and discuss differences between term and preterm infants. In Part II, we will be going over major considerations for the initial stabilization of a premature infant, as well as a systems-based approach to recognizing and managing common short-term complications associated with prematurity.

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