

The Yellow Clue:

An Interrupted Case Study of Neonatal Hyperbilirubinemia

by

Latia Moddelmog¹, Jonathan M. Conard², and Melissa M. Conard³

¹Harding University, Searcy, AR

²Department of Natural Sciences, Sterling College, Sterling, KS

³Sterling Family Care, Sterling, KS



Part I – Pre-Delivery

Ever since Adam Wittman got the news from his wife, Grace, that they were finally expecting their first child after a year of trying, he had been feeling a range of emotions: relief that they finally were able to conceive, a lot of love for the little baby already, a little bit of fear and anxiousness for all of the unknowns about raising a child, and most of all, joy and excitement for their child to finally be in their arms. Since this was their first baby, Adam and Grace had no idea what to expect and were doing everything they could to prepare and to gain as much knowledge as possible about caring for a newborn.

Their family practice doctor was Dr. Williams; she had been very patient and helpful with all of the couple's questions and had done a great job educating them. Adam had also started reading books about infant care. One chapter he found especially intriguing was about neonatal disorders and the signs of these disorders in the newborn. Conditions like hypoglycemia, heart murmur, hypoxic-ischemic encephalopathy, hyperbilirubinemia, reflux, and feeding intolerance were just a few that he read about. Since he had little medical knowledge, the words seemed complex and overwhelming. One symptom to watch for that he had recognized was the newborn developing jaundice. He remembered this term from when his grandfather had liver disease and his skin and eyes turned a yellowish color, which made him scared at the thought of seeing his baby yellow. However, the book explained that in an infant, jaundice was easily treatable with a low chance of any major damage resulting from it. Other signs that something may be wrong were poor feeding and not gaining weight, persistent and high-pitched cries, lack of energy and long periods of sleep, and irregular respirations. Adam continued reading and researching to understand more about how to keep their child as healthy as possible after birth.

Questions

1. What are some of the common neonatal disorders Adam found?
2. What are visible signs of jaundice in a newborn that Adam remembered from the book?
3. What condition caused Adam's grandfather to develop jaundice?
4. Jaundice can be caused by elevated levels of bilirubin in the blood. What is the normal role of the liver in processing bilirubin?

Part II – Delivery and Symptoms

It was early in the morning when Grace was struggling to sleep after she had taken one of her many trips to the bathroom during the night. She decided to get up and make breakfast. She had just gotten out some eggs and bacon to begin cooking when she felt a sudden rush of fluid down her legs, as if she were unable to control her bladder. When she looked down and saw a large puddle beneath her she quickly realized that her water had broken. Grace felt an instant rush of fear because it was too early for her to go into labor as she was only 36 weeks pregnant. She rushed to wake up Adam and while he was also scared, he tried to keep her calm as best he could. They scrambled to get the bags they had prepared for this event and drove to the hospital.

As they drove, Grace began to feel subtle pains in her abdomen, and she knew this baby would be coming soon. Once they arrived at the hospital, they explained the situation to the staff. They were then sent to the labor and delivery unit and delivery preparations began. The nursing staff hooked Grace up to multiple monitors, started an IV, monitored the baby's heart rate closely, and checked her cervix regularly. They also eased the soon-to-be parents' nerves about the preterm labor, saying the baby's heart rate appeared normal on the monitor.

Later in the day after more tests, checks, and increasingly intense contractions, Grace was fully dilated and ready to begin pushing. After an hour of pushing, Grace gave one final effort and a few seconds later heard the loud cries of her new baby girl. Adam and Grace were overcome with joy and love for her and they named her Callie. They spent the next 48 hours in the hospital in awe of their new child. Since they had chosen to breastfeed her, they had to learn and adjust to that as well. Even though baby Callie was born preterm (less than 37 weeks), her lab tests and vital signs after birth were healthy and normal. The only concerns the nurses found were that Grace was occasionally struggling to breastfeed and that Callie had lost slightly more weight after birth than expected. However, Callie would eventually latch on and be fed, and the amount of weight that she had lost since birth was not concerning enough to remain longer in the hospital.

They were discharged to go home with instructions to closely monitor Callie's feedings, her eliminations, and her color for the next few days. Adam and Grace were excited to begin this journey as new parents and listened carefully to all of the instructions from the hospital staff. After two days at home, Callie was feeding much less than she should. She would either sleep through her feedings or cry intensely and not latch on. They also noticed her diapers did not need to be changed as frequently. Shortly after recognizing these signs, Adam also observed that Callie's skin on her face and chest appeared much more yellow than normal. Adam recognized all these symptoms from the book he had read and Dr. Williams's instructions. Fortunately, they had a routine follow-up appointment scheduled with Callie's doctor and were able to take her to be seen that day.

Questions

1. Before how many weeks is labor considered preterm?
2. What signs did Callie have that caused slight concern in the hospital?
3. What signs did Callie develop at home after being discharged from the hospital?

Part III – Diagnosis and Treatment

After the family arrived at her office, Dr. Williams did a full examination of Callie and was concerned about her jaundiced color and changes in her feeding. She had blood drawn immediately to measure total serum bilirubin to help confirm her diagnosis. Dr. Williams explained to Adam and Grace, “Callie has neonatal hyperbilirubinemia, which means she has too much bilirubin in her blood. Too much bilirubin is what causes the yellow skin color. Being a premature baby and not feeding enough can increase the risk for this condition. The blood test I ordered confirmed her high bilirubin levels, with her total serum bilirubin being 20 mg/dL. This is an elevated level, so we are going to admit her back into the hospital to begin treatment. She will need to go through phototherapy and the nurses will monitor her to make sure her levels decrease.”

The couple was feeling overwhelmed as they tried to understand the diagnosis and process going back to the hospital. Adam asked, “What is phototherapy treatment? This must be serious if she’s going to be readmitted to the hospital?”

Dr. Williams answered, “Phototherapy is a specialized blue wavelength light that Callie will be kept under at all times unless feeding. This light will change the bilirubin to a form that can be excreted through urine, which will help decrease the levels in the blood. It is also important that breastfeeding continues as this will help hydrate her and give her nutrients to help reduce the bilirubin levels. Right now she is in the early stages so it is not yet serious. However, it is crucial to decrease the levels as quickly as possible or it may become serious.”

After leaving the appointment, they went directly to the hospital and Callie was placed under a blue phototherapy light and on top of a phototherapy blanket. The nurses instructed Grace to feed her every two to three hours to get back on a regular schedule and examine her color each time she was taken out of the light.

Questions

1. Answer the following questions using information from the CDC website at <https://www.cdc.gov> (search for the article “Jaundice and Breastfeeding”).
 - a. What is bilirubin?
 - b. Why are elevated levels of bilirubin not uncommon in newborns?
2. What are some conditions that may have contributed to Callie developing hyperbilirubinemia?
3. What treatment did Callie undergo? Why does this help reduce bilirubin levels?
4. Using a textbook or outside sources, explain how bilirubin is normally removed from the body.

5. One way that bilirubin is removed from the body is by excretion of conjugated bilirubin in the urine. When producing urine, why are normally functioning kidneys able to excrete conjugated bilirubin but not unconjugated bilirubin?
6. During the first few hours of life, the red blood cell (RBC) count of a newborn is approximately 4.75 million RBC per cubic millimeter. After this time, the red blood cell count progressively declines until reaching around 4 million RBC per cubic millimeter by six to eight weeks of age. Bilirubin levels tend to increase in the first several days following birth. Why might a declining red blood cell count be related to an increased level of bilirubin?
7. The BiliTool website (<https://bilitool.org>) can be used to determine treatment recommendations based on the American Academy of Pediatrics (2022) guidelines for managing hyperbilirubinemia. This web-based tool determines recommendations based on total serum bilirubin levels, gestational age, age (in hours) at sampling, and the presence of other risk factors.

Use the BiliTool site and enter the observed values for Callie based on her gestational age, total serum bilirubin levels, and age (hours) at sampling (use 72 hours). Assume that Callie has no other risk factors.

- a. With this information, was Dr. Williams' recommendation for phototherapy treatment consistent with the AAP recommendations (based on entering the observed values in the BiliTool site)?
- b. Using the BiliTool site, how high would Callie's total serum bilirubin levels have to be in order to reach the threshold for an exchange transfusion?

Part IV – Recovery

While in the hospital watching their baby receive treatment, Adam and Grace started to become worried. They asked their nurses many questions about Callie's condition while trying to stay calm. Adam began Googling the seriousness of hyperbilirubinemia if her levels did not decrease. He found that bilirubin is toxic to the brain if it passes the blood-brain barrier, which could cause permanent neurological damage such as intellectual disability, hearing impairment, or cerebral palsy. He was relieved to read that this condition, called chronic bilirubin encephalopathy or kernicterus, was rare because symptoms are usually treated in enough time to prevent it.

As Grace was breastfeeding Callie, she began to question if breastfeeding was the right choice for their baby, even though Callie was feeding regularly and seemed to be getting enough milk. She brought these concerns to the nurse, who reassured her that breastfeeding was very beneficial for Callie and that she was now getting adequate amounts of milk and that there was no reason to regret her decision.

After Callie spent a day under phototherapy and follow-up blood tests were done, her bilirubin levels had decreased to an acceptable range. Adam and Grace were thankful that Callie was healthy enough to go back home, although they knew that she would need to return to the clinic for bilirubin checks over the next week to make sure that her levels had stabilized.

Questions

1. Why is it important to treat hyperbilirubinemia quickly?

2. Why is hyperbilirubinemia more common in breastfed babies than those fed with formula?

See the following article:

- Clark, M. (2013). Clinical update: understanding jaundice in the breastfed infant. *Community Practitioner* 86(6): 42–4. <<https://pubmed.ncbi.nlm.nih.gov/23821885/>>

3. The nurse reassured Grace that breastfeeding was beneficial for Callie. What are some of the benefits of breastfeeding for an infant and the mother?

See the following article:

- Meek, J.Y., L. Noble, and the Section on Breastfeeding. (2022). Policy statement: breastfeeding and the use of human milk. *Pediatrics* 150(1), e2022057988. <<https://doi.org/10.1542/peds.2022-057988>>