

The Case of the Newborn Nightmare

by

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Part I—Trouble in the Nursery

“Flesh eating bacteria? You’re kidding, right?” Dr. Mark Maddison winced as he tried to understand the alarmed nurse at the other end of the phone. “Slow down and tell me again what’s happening.” Mark knew that he needed to stay calm and try to buy time to understand the problem. It was the first time he had been left as the sole physician in charge of the struggling Black Rock Clinic. Dr. Jullie Elridge, the seasoned senior physician in their partnership, had left for Nepal two weeks earlier on a three-week expedition to climb Mount Everest.

The nurse, Jill Benoit, continued, “All I know is that I have three really sick babies down here. The Willis twins started to go bad yesterday. They have a strange rash on their thighs and they’re running a fever. I thought it was just ordinary diaper rash, but this evening when I was rubbing some ointment on it, the skin started coming off in sheets! Now the Levi baby looks like she has the same thing under her arms.”

“You haven’t started using some new lotion or soap on them, have you?” asked Mark, hoping that he wasn’t going to have to resurrect his knowledge of infectious diseases. “Perhaps you’re using something that’s too harsh for the skin of neonates.”

“No, no,” Jill answered impatiently. “I’ve been working in neonatal nurseries for 25 years. I think I know a thing or two about washing babies. Can you reach Dr. Elridge? She knows how to handle these sorts of things.”

Mark resisted the urge to snap back at her. If he had to call Jullie in Nepal he’d never live it down. “No need to call her. She left me in charge. I just need to take a look at the little guys. I’ll be right up.”

Mark took the stairs up to the nursery two steps at a time. Turning down the hallway he could see a small cluster of visitors cooing and waving at a small red-faced infant being displayed through the nursery’s large plate glass window. Behind them Nurse Benoit was hovering over an isolette. Mark hurriedly washed his hands and walked over to the isolette to examine the baby.

Jill didn’t look up when he arrived but simply murmured “Dr. Maddison” under her breath as if his name were something distasteful. The Levi baby was wearing a tiny knit cap and was wrapped tightly in a hospital blanket. Mark gently unwrapped the blanket and lifted up the baby’s white undershirt to examine her skin. He could see some small vesicular lesions on the inside of her upper arm. Farther up, in the axillary area, there was a moist red area about the size of a quarter. The baby girl seemed warm to the touch, and she began to fuss and wave her fists in response to his probing. He replaced the blanket and walked over to the isolette that held the first of the Willis twins.

“Baby Boy A is worse than his brother,” Jill called from across the nursery. Mark undressed Baby Boy A and removed his diaper to look at the affected area. The entire area of the tiny baby’s groin appeared to be involved, demonstrating the same strange skin infection. Maybe Jill was right—perhaps this was the beginning of necrotizing fasciitis, the famed “flesh eating bacteria” of tabloid lore. No matter what it was, he needed to act quickly to avoid any kind of negative publicity.

Mark looked up in time to see Bill Alkin, the clinic administrator, enter the nursery wearing a grey pinstripe suit that seemed oddly out of place in the antiseptic and starched white surroundings of the

nursery. “Dr. Maddison,” Bill said curtly. “Nurse Benoit has notified me that we have a potential situation here in the nursery. It looks as though we need to give Dr. Elridge a call.” Mark shot Jill a withering glance, but she studiously ignored it. “No, no,” he replied. “I’m sure I can handle this. Besides, Jullie has probably already started up the mountain. She’s undoubtedly out of contact with everyone, except perhaps her Sherpa guides.”

“For your sake, I hope you’re right about being able to handle this,” Bill countered. “We can’t afford to have an epidemic in the news. You know that Whitley Memorial Hospital has been looking for an excuse to shut us down. I’m sorry, but I can’t risk losing this clinic just so that you can pursue some idea of being a hero. I’ll give you 24 hours—after that I’m quarantining the nursery and calling in the county health department. If there is any negative publicity about delaying even a day, I’m holding you personally responsible.” With that, Bill turned abruptly and headed out of the nursery.

Mark looked down at the mewling infant and soberly rewrapped him in his powder blue blanket. “Well, Dr. Maddison?” Jill inquired, her voice tinged with sarcasm. “What are your instructions?”

“I’ll have them written out for you as soon as I check on a few details,” Mark responded. He was going to have to read up on infectious agents that could cause this kind of a skin disorder—and fast. Mark wished he had been a better student of infectious diseases. He hated to admit it but he had just barely passed that part of his education. The reference collection in the clinic library was a bit sparse and somewhat outdated, but at least it was a place to start.

Questions

1. What are the challenges Dr. Maddison is facing?
2. What information does he have so far about the infection?
3. What are some possible causes of skin infections? List at least five different organisms.
4. What should Dr. Maddison’s next move be in determining the cause of the babies’ infection?

Part II—Plan of Attack

Mark sighed as he took a look at the lengthy list of potential pathogens he had jotted down while paging through the library textbooks and reference manuals. “Cutaneous candidiasis, generalized Herpes, impetigo, even leprosy!” he muttered to himself. The organisms and diagnoses seemed limitless. The few hours he had spent researching a possible cause had, however, jogged his memory of infectious diseases. He decided his best course of action was simply to take samples from the affected areas and submit them to the microbiology laboratory for stain and culture.

Mark returned to the nursery armed with a set of culture swabs. Jill peered furtively through lidded eyes as he went from isolette to isolette collecting specimens from each baby. Brandishing the culture swabs like weapons, he then marched out of the nursery and down the stairs to the microbiology lab.

“Good afternoon, Dr. Maddison.” Mark stole a glance at the badge pinned to the lab coat of the young woman who greeted him. He could never figure out how people he couldn’t remember ever meeting seemed to know him by name. Anne Mosel, MT(ASCP)SM, the badge said.

“Ms. Mosel, I have a few specimens from the nursery that need priority treatment. The specimens were taken from some unusual skin lesions on three of our infants. I know that we need at least a routine culture and sensitivity with Gram stain. I could order some more esoteric testing, but I’m hoping that we can get some clues from this initial work.”

“We’ll set up the Gram stain right away. I’ll have one of my best microbiologists work just on this case until we can get some answers. If you wish, Dr. Maddison, you can stay here and read the direct Gram stain yourself.”

Questions

1. You are the microbiologist in charge of reading the Gram stain for this case. From your instructor, obtain a specimen. Unless it is already stained, stain the specimen and examine it microscopically. Record your observations of Gram reaction and morphology of any bacteria you observe. Also record the presence of any host cells, such as epithelial cells or white blood cells.
2. List at least two genera of clinically significant bacteria that are consistent with your observations.
3. List at least two kinds of culture media that will support the growth of the above organisms.

Part III—Tracking the Culprit

After the microbiologist finished Gram staining the specimens and had examined them, Dr. Maddison sat down to see if his assessment of the specimen agreed with the microbiologist's. He peered into the microscope, straining to see if he could find any clues there to the mystery. As his eyes focused, he began to see clusters of purple spheres amid some cells that appeared to be a mixture of squamous epithelial cells and neutrophils. "Gram positive cocci!" he exclaimed. "Now which genera of clinically significant bacteria are Gram positive cocci that could cause an infection of the skin?" he said to no one in particular.

"Staphylococcus, of course," responded Anne Mosel. "And Streptococcus. They're two of our most popular isolates from skin specimens."

Mark found the idea of bacteria being "popular" an odd one, especially bacteria that could cause the nasty lesions he had seen in the nursery. Moreover, both staph and strep struck him as too tame to be causing the problem. The flesh eating bacterium, *Streptococcus pyogenes*, fell into that group though. Perhaps it would be an open-and-closed case after all. Mark shuddered as he imagined the reporters who would storm the clinic once word leaked out to the media that the Black Rock babies were being "eaten alive."

"I was just thinking about media," Mark remarked to Anne. "We can use pretty typical media to isolate those, right?"

"Yes, we would usually set up these specimens on five percent sheep blood agar, MacConkey agar, and CNA or PEA agar. We also frequently set up a liquid culture along with the plates."

"That sounds like a good plan. I'll check back first thing in the morning to see if there's any growth on the plates." Dr. Maddison thanked Anne and the microbiologist who had helped him and went back upstairs for a last check on the sick babies before heading home for some much-needed rest.

Upstairs, he nearly ran into Bill Alkin, the hospital administrator who had given him an ultimatum earlier. "Hello, Bill," Dr. Maddison said tersely. "What brings you out of the administrative suite for a second time today?"

"There are some mighty agitated parents in the nursery, Mark. I think you need to convince them that you have a reasonable plan for taking care of their kids." Bill turned and began walking back toward his office. "Remember," he called over his shoulder to Mark. "Controlling this outbreak is only half of your problem—controlling the damage is also your concern."

Mark looked through the window of the nursery in order to size up the situation before entering. He saw a well-dressed couple in their mid-30s standing beside the Willis twins' cribs. The woman was quietly weeping while the man had his arm protectively wrapped around her. Nurse Benoit was standing next to Baby Girl Levi's isolette, deep in conversation with a woman with red hair wearing a chenille bathrobe. The woman was clearly agitated.

Resisting the urge to turn on his heel and flee, Mark pushed open the door and entered the nursery. The couple next to the Willis twins continued their mournful vigil without seeming to notice his presence.

Mark heard Jill say to the woman in the bathrobe, “Here’s Dr. Maddison now. I’m sure he has some information for you.”

Mark approached the woman with his right hand extended. “I’m Dr. Maddison. You must be Mrs. Levi. Congratulations on the birth of your daughter.”

“Where’s Dr. Elridge?” said the woman, ignoring his outstretched hand. “She’s taken care of my other two. No offense, but I want my own doctor taking care of Lilly.”

“Lilly—what a beautiful name,” Mark said, hoping to put Mrs. Levi at ease. “Dr. Elridge is out of the country for a few weeks. She left me in charge. I’ve already ordered some tests to help us determine the best treatment for Lilly.”

“Treatment? Just what did she catch from those other babies? Her skin has this terrible rash that’s peeling off! She looks awful. What kind of a place is this anyway?” The color rising in Mrs. Levi’s face was beginning to match that of her hair. “If Dr. Elridge can’t take care of her, I’m taking her to Whitley Memorial Hospital right now.”

Dr. Maddison took a deep breath and responded in a measured tone. “I’m sorry, Mrs. Levi, but I can’t allow you to take Lilly right now. She’s too sick to be discharged, and Whitley won’t admit her into their nursery in this condition anyway.”

“You can’t keep my baby here! I’m calling my brother-in-law first thing in the morning. He’s editor of the biggest newspaper in the county. He’ll make sure people know what kind of a clinic you’re running.”

“Let’s try not to panic, Mrs. Levi. The microbiology lab is zeroing in on the cause of your daughter’s illness even as we speak.” A bit of an exaggeration, Mark knew, but not an outright lie. “I’ll stop by your room in the morning and let you know what we’ve found. I’m sure we’ll have this solved by then.”

“You better have it solved by then. I’ll be waiting to hear from you, Dr. Maddison—but I won’t be waiting for long.” Mrs. Levi turned, pushed open the nursery door, and walked out.

Mark sighed. “Would you please fill in the Willis parents?” he said to Nurse Benoit. Jill looked stunned by the exchange she had just observed. Surprisingly, she simply nodded and walked over to the couple standing by the cribs and gently began speaking with them. Mark took the opportunity to escape, walking quickly to the clinic exit and out into the cold night air. Tomorrow would be here sooner than he wanted.

Questions

1. Did your assessment of the Gram stain agree with Dr. Maddison’s? If not, can you explain why your answer might have been different?
2. Assuming that the organisms are indeed Gram positive cocci, tell the purpose of each of the media selected by Ms. Mosel to attempt to culture the organism.
3. Which aerobic Gram positive cocci are normal flora on the skin?
4. If aerobic Gram positive cocci grow on the plates, what initial tests should be performed to identify them?

Part IV—Closing in on the Quarry

Questions

1. As the microbiologist assigned to this case, your next assignment is to identify the organisms in the cultures provided. Perform the following tests in sequence:
 - observation of colonial morphology
 - Gram stain and observation of microscopic morphology
 - catalase
 - tube coagulase
2. Record your results on the following table:

Test	Result
Colonial Morphology <ul style="list-style-type: none">• Blood Agar• PEA or CNA• MacConkey	<ul style="list-style-type: none">•••
Gram reaction and morphology	
Catalase reaction (positive or negative)	
Coagulase reaction (positive or negative)	

3. Based on these results, identify the organism you have isolated.

Part V—Eureka!

Mark cautiously pushed open the door to the microbiology lab and glanced around the room. He could just make out the top of Anne's head, barely visible behind several tall stacks of multi-hued bacteriological media as she bent over a culture. "Don't these people ever sleep?" he wondered, simultaneously admitting to himself that his night had not been exactly restful. Mark cleared his throat, hoping to get her attention without appearing too eager. Anne looked up, smiled, and set aside the culture she had been examining.

"Any new information on those nursery cultures, Ms. Mosel?"

"Oh, yes, of course, Dr. Maddison. We called the report up to the floor earlier this morning. Let me show you what we found." She pulled a microscope slide from a small cardboard box and placed it under her microscope. "Take a look for yourself."

Mark sat down and began to scan the slide. Spread out across it was a sea of round purple spheres that looked like those he had seen on yesterday's slide of the lesions. "So many," he observed.

"Yes," Anne responded. "This smear was taken from a culture plate, so there will be a large number of organisms. Here are the plates, if you'd like to have a look."

Mark picked up the sheep blood plate first. It was covered with round, opaque creamy colonies. He held the plate up to the light to get a better look and noticed that there was a halo around each tiny colony where the sheep blood appeared to be missing from the agar. The plate labeled "PEA" looked nearly identical. Mark sniffed the plate, enjoying the scent, which reminded him of the Rose Milk lotion his grandmother used to use. Finally, he picked up the lavender plate labeled "MAC" and held it up to the light. Except for the tracks left in the pattern of the microbiologist's inoculating needle, the plate looked completely barren.

"We performed catalase testing on the isolate," interjected Anne. "You should have seen the way it bubbled! We have a rapid agglutination test in this laboratory that we used instead of the coagulase test. This isolate was a strong positive. There's no doubt about its identity now, is there?"

Mark closed his eyes and rubbed his temples in an attempt to dislodge the buried bits of information. "Why, it looks for all the world like *Staphylococcus aureus*!" he said, surprised by the confidence of his answer.

"Exactly!" replied Anne. "We have antimicrobial susceptibility testing already set up and running. Using our automated system, we may have the results available later today."

"Great day in the morning!" Mark jumped up from his seat, grabbed the shoulders of a very startled Anne Mosel, and planted a kiss right in the middle of her forehead. He then turned, tossed open the laboratory door, and trotted down the hallway toward the medical library.

Back in the library, Dr. Maddison went straight to the small pile of reference books he had been working with the previous evening. Choosing a likely looking volume entitled *Pediatric Infectious Disease*, he looked up *Staphylococcus aureus* in the index. There were about a dozen pages listed. "Hmmm, impetigo is less generalized than these babies are showing... food poisoning in breast-fed babies just doesn't

sound right at all....” Mark continued to flip pages, more and more impatiently. Abruptly, he turned a page and met the gaze of a newborn staring unflinchingly out at him. Except for the tiny hat stenciled with the name of an unknown hospital, the newborn could have been one of his patients in the nursery. The baby was pictured lying in a crib naked except for the hat. There was an angry looking rash extending from the baby’s groin upward to above his umbilicus. The skin had peeled away from the rash, leaving a moist, bright red surface. The caption read “Neonatal Staphylococcal Scalded Skin Syndrome.”

“Hmmm,” Mark muttered. “I know that staphylococci can cause some wicked wound infections, but why the rash?” He scanned the chapter looking for information about the disease mechanism. “Of course. There’s a toxin, an exfoliatin, that’s causing the skin to peel away.” He continued reading:

When treating staphylococcal scalded skin syndrome, the first goal is to stabilize the patient through measures such as rehydration. Elimination of the offending S. aureus is the next goal. Most commonly, and in more serious cases, intravenous antibiotics are administered, including beta-lactamase resistant penicillins, first generation cephalosporins, macrolides, and aminoglycosides. With treatment, the prognosis for children is excellent.

“Time to write some orders!” Dr. Maddison pushed back his chair and strode down the hall toward the nursery. As he entered, he could see that Bill Alkin was there trying to soothe Mrs. Levi. The Willis parents were still staring mournfully down into the twins’ isolettes. Nurse Benoit glanced resignedly at him.

“Good morning, everyone! How are our patients doing today?” Mark walked over to the Levi baby’s chart and flipped it open. “Good news, Mrs. Levi, we have a diagnosis for Lilly, and I am prescribing a medication that should have her skin back to its former beauty in just a few days. Mr. and Mrs. Willis, your little ones should be on the mend very soon, too.”

Mark pulled Bill aside and discreetly murmured, “We still need to work with the health department to trace the source for this organism. I’d like to collect nasal swabs from anyone who has had contact with these babies. Clinic staff, including myself, are the most likely source.”

Bill’s eyes darted furtively to the others in the room as he whispered, “You won’t mention this to anyone else, of course.” He placed his hand on Mark’s shoulder. “I knew we could count on you, Mark.”

“Sure, Bill. Thanks,” Mark answered wryly.

The nursery phone rang and Mark walked over to answer it. He could hear static and then, faintly in the background, Dr. Elridge’s voice. “Mark, is that you? I only have a few seconds on this line. I’ve just returned from the summit! I’m having the time of my life! How is everything there?”

“Well, hello, Explorer! Everything’s under control here, Jullie. I’ll fill you in when you get home. Have a great time!”

Questions

1. Many people, especially healthcare workers, carry *Staphylococcus aureus* in the anterior nares. How, then, are infections passed from these caregivers to their patients? How can transmission be prevented?
2. Tracing the source of an outbreak of *Staphylococcus aureus* often involves a technique known as phage typing. What is phage typing, and how could it help to understand an individual outbreak?

Part VI—From Nightmare to Naptime

Mark stuffed his pen into the pocket of his rumpled white coat and flipped shut the chart he had been working on. It made a comforting thud as Mark slid it back into the rack. “Discharge orders are written for the Willis twins and the Levi baby, Nurse Benoit,” he announced. He felt a sense of elation, as though he were completing an arduous journey. “Would you please let the parents know they can take their children home this afternoon?”

“Thanks, I’ll take care of that,” Jill responded. “Mrs. Levi is in with her baby now. She was looking for you earlier.”

Mark’s heart sunk a little. He had been hoping to avoid any more confrontations. Jill Benoit had been considerably less challenging the past few days. The report from the health department that she carried in her nares the same staphylococci that caused the outbreak in the nursery had subdued her somewhat. Mark had treated her with an antibiotic, and together they had reviewed the gloving and handwashing protocols for the nursery.

Given the dramatic improvement in the babies, Mark just couldn’t imagine what Mrs. Levi could come up with to cast a shadow over his day. Slowly he turned and headed into the nursery.

“Dr. Maddison!” He turned toward the voice and greeted Mrs. Levi. “Dr. Maddison, I’ve been waiting for you.”

“Mrs. Levi, how are you this morning?” Mark tried to conjure up his most charming smile. “Can I answer any questions for you?”

“Oh, Dr. Maddison! I just wanted to thank you for everything you did for Lilly. I’d like to have you continue to be her doctor after she is discharged. Do you think that Dr. Elridge would be offended?”

“I’m sure she would want you to do whatever makes you comfortable, Mrs. Levi. Besides, she often covers for me when I’m unavailable. I’d like to see Lilly on Monday, just to make sure that she continues to do well.”

“I’ll make an appointment for Monday, then. Thank you again, Dr. Maddison!”

Mark gave her an appreciative smile and headed out the door and toward the parking lot. He was thinking he had an appointment of his own to make—for a long, restful weekend nap.