

NIH Pain Consortium

Centers of Excellence in Pain Education



Adolescent Sickle Cell Disease Case

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Introduction

This is a case about a teenage girl who is coping with pain crises related to sickle cell disease (SCD). The case provides a history of the disease onset and progression from infancy through high school as seen from her perspective (In her own words) and explained by case principals. The case then provides details of a pain crisis episode as she prepares to transition from high school to college (Clinical Encounters). At the end of the case, she is better prepared to handle pain management as she continues her path towards adulthood (The Road Ahead).

Case Goals and Objectives

Broad Goals

- Describe the diagnostic features and pathophysiology of sickle cell disease (SCD).
- Discuss both pharmacologic and non-pharmacologic treatment strategies for SCD in an adolescent, using an integrative medicine approach.
- Discuss psychosocial, environmental, and lifestyle factors that may trigger an SCD crisis or complicate treatment.
- Engage with members of the interdisciplinary team to provide patients with multiple approaches to pain management, in keeping with the patient's preferences, particularly when pain is chronic and severe.
- Demonstrate how to encourage active self-management by adolescents, in concert with ongoing provider care, as they transition to adulthood and the adult healthcare system.

Discipline-Specific Learning Objectives

Hematology

1. Review acute pain assessment and management in SCD patients.

2. Discuss ways to teach and support self-management of adolescents and young adults with SCD as they transition to adulthood.
3. Transfer essential information about the SCD patient at times of transition between providers.

School Nurse

1. Given that good pain control reduces absences from school, discuss the complex role of the school nurse in managing and advocating for adolescents with SCD.
2. Describe the nurse's role in helping students with pain control, including development of a 504 plan that enables a student to obtain accommodation appropriate to their medical condition in required academic and physical activities.
3. Discuss why some students with SCD refuse to disclose their illness to schools and classmates, and how school nurses can help to protect their confidentiality.

Population Health

1. Identify barriers to care for adolescents with SCD, including implicit bias among care providers.
2. Discuss the specific challenges that adolescents with SCD face as they transition to self-management in the adult health care system.
3. Discuss resources available to SCD patients, including support groups, and how they might access these, locally and nationally.

Pharmacy

1. Educate adolescents with SCD on realistic pain management expectations, and help transition to self-management of their care.
2. Design an appropriate pharmacologic and non-pharmacologic pain management regimen for patients with SCD that reflects specific patient and environmental factors.
3. Counsel patients with SCD on safe and appropriate use of hydroxyurea and analgesics.

Pharmacology

1. Describe the process of hematopoiesis
2. Describe the pathophysiology of sickle cell disorder
3. Describe the pain pathways associated with sickle cell disorder

Psychology

1. Describe how clinical psychology can foster patient understanding of the biopsychosocial model and cognitive-behavioral framework, and how such understanding can promote enhanced health and wellness.
2. Identify behavioral and other non-pharmacological strategies for stress and pain management.
3. Discuss the medical team's role in helping the SCD patient to transition from pediatric care to adult care.

Physical Therapy

1. Describe the role of the physical therapist in treating the cardiothoracic, musculoskeletal, and nervous system effects of SCD.

2. Describe the role of the physical therapist in educating an individual with SCD about the potential benefits and risks of various forms of exercise.
3. Discuss how physical activity may help an individual with SCD to maintain good health.

Acupuncture

1. Discuss the relevance of acupuncture to the management of acute and chronic pain.
2. Describe how a licensed acupuncturist examines and diagnoses a patient with SCD.
3. Discuss the current evidence base relating to acupuncture and SCD.

Study Questions for the Adolescent Sickle Cell Disease Case

1. What are special considerations for treatment of an adolescent with SCD, compared to a young child or an adult?
2. What SCD triggers should be considered in creating a personal disease management plan for Sharee?
3. How does Sharee attempt to avoid crises and to manage her pain when episodes occur?
4. How does the patient's transition to adult life affect her strategies for self-management?
5. Why is non-pharmacologic treatment recommended in addition to treatment with medications during a pain crisis?

Case Principals

Sharee

Sharee is a young adult who tells her personal story about growing up with sickle cell disease and multiple pain crises. She now has concerns about her future care as she transitions away from home and the care of her pediatric providers to be a college student in the world of adult medicine.

School Nurse

Karen Parker has been the nurse at Sharee's high school of 1200 students for 15 years. The "Nurse's Office" has two visitor chairs as well as a refrigerator, a scale, and other equipment; a half bathroom; and a room with an exam table and a single bed separated by a curtain. An additional room serves as a counseling office.

Acupuncturist

Dr. Ergil is a licensed acupuncturist (LAc), who has taught and practiced acupuncture and Chinese medicine at several institutions over the past 30 years. He sees patients of all ages with a variety of conditions including both acute pain and chronic pain syndromes.

Hematologist

Suzie Noronha, MD, is a pediatric hematologist, who directs the Sickle Cell Program at a major children's hospital. She also helps lead the Sickle Cell Support Group recently established in the community. This group welcomes patients of all ages and their family members to meetings and social events.

Physical Therapist

Linda Riek, PT, DPT, PhD is a physical therapist, researcher and faculty member in a physical therapy program. Individuals with SCD are encouraged to #ChoosePT to battle the opioid epidemic at www.moveforwardpt.com. The American Physical Therapy Association (APTA) has launched the #ChoosePT campaign to raise awareness about

the dangers of prescription opioids, and encourages consumers and prescribers to follow guidelines from the Centers for Disease Control and Prevention (CDC) to choose safer alternatives, like physical therapy.

Psychologist

Andrew Cohen, PhD, is an academic clinical psychologist who has experience working with patients with sickle cell disease and their families. He also cares for patients with headache, abdominal pain, and a variety of behavioral/mental health issues.

Inpatient Pharmacist

Kate Juba, PharmD, is a pharmacist who practices and teaches within the hospital setting. She holds a faculty position at a School of Pharmacy.

Outpatient Pharmacist

Angela Nagel, PharmD, is a pharmacist who practices and teaches primarily within the community. She holds a faculty position at a School of Pharmacy.

In Sharee's Own Words

Sharee As an Infant

A video shows Sharee facing the camera directly in a head and shoulder shot. She's wearing a red sweater and hoop earrings, with her hair held back by a headband. She's in front of her living room window, with the curtains drawn. You can see the front yard in the background with a neighbor's house opposite, partially obscured by trees. Sharee begins, *"Hi, my name is Sharee. I'm 19-years-old and have sickle cell disease, which my parents learned when I was one month old."*

A photo accompanies the video. It shows Sharee as an infant.

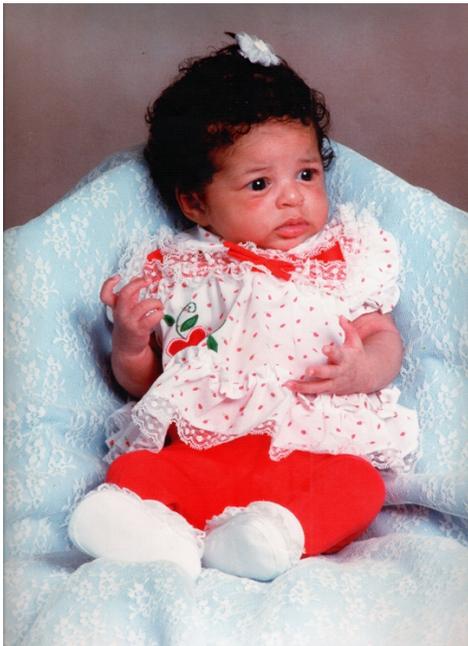


Figure 1: Sharee at 1-month-old

The video continues. Sharee's hematologist, Dr. Suzie Naronha appears in a patient examining room. A dividing curtain is halfway drawn behind her, splitting the room in half. Upper cabinets above a countertop that holds medical books, disinfectant gel, and a telephone can be seen on the right of the screen. Dr. Naronha wears glasses and her hair down. You can see her

name embroidered on her white lab coat in the head and shoulder shot, followed by the words, “Pediatrics, Hematology,” stitched after.

“I’m Doctor Suzie Naronha,” she says, “a pediatric hematologist, specializing in sickle cell disease¹. (Sickle cell) disease is an autosomal recessive inherited disease. Thus, each parent must be a carrier, have sickle cell disease, or a combination. The disease is common enough that it is part of routine newborn screening. This result is sent to the primary care physician, who informs the family and refers the baby to the regional hemoglobinopathy center.”

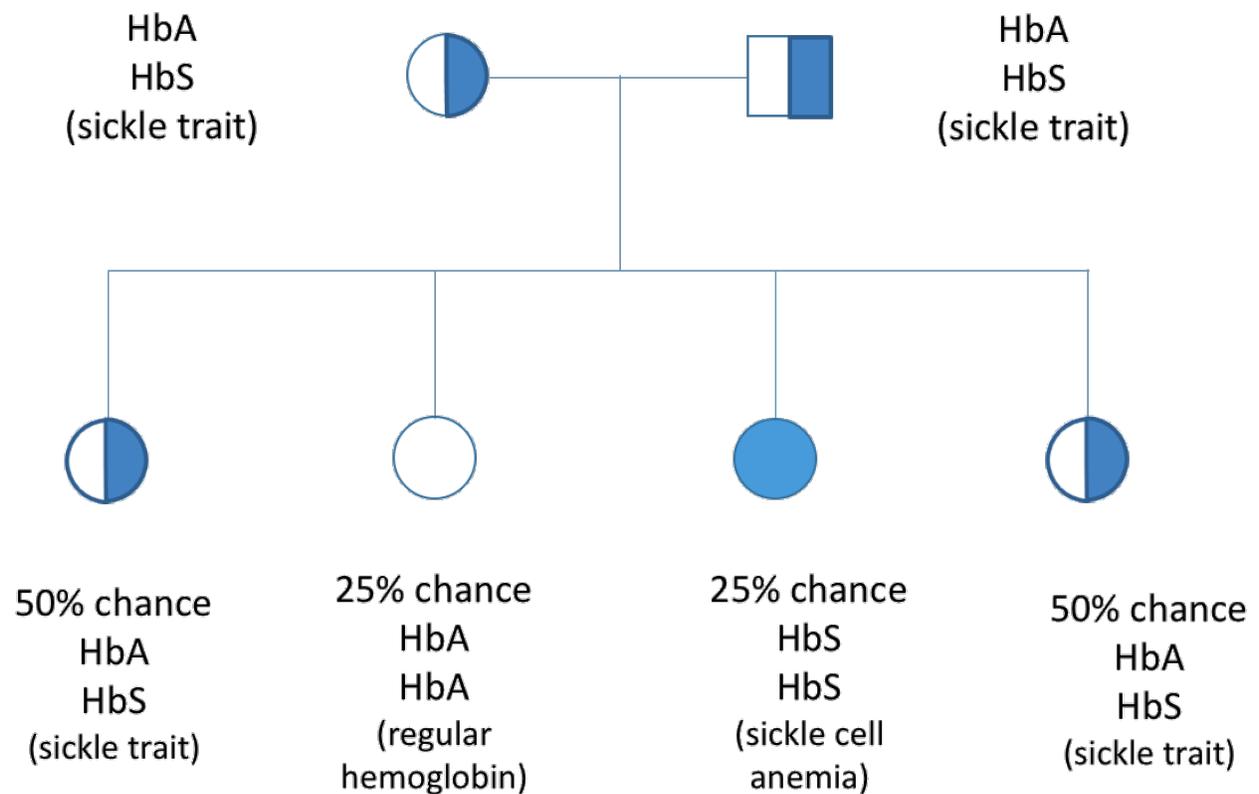


Figure 2: Genetics of HbSS

¹ <https://www.nhlbi.nih.gov/health-topics/sickle-cell-disease>, <https://www.cdc.gov/ncbddd/sicklecell/index.html>

Sharee and Symptom Onset

A video shows Sharee facing the camera directly in a head and shoulder shot. She's wearing a red sweater and hoop earrings, with her hair held back by a headband. She's in front of her living room window, with the curtains drawn. You can see the front yard in the background with a neighbor's house opposite, partially obscured by trees.

She says, *“My parents tell me that I was well until I was about 7 months old. (That’s) when I developed swelling in the joints of my hands.”*

A photo accompanies the video. It shows Sharee at 7-months-old.



Figure 3: Sharee at 7-months-old

The video continues with Sharee's hematologist, Dr. Suzie Naronha appearing in a patient examining room. A dividing curtain is halfway drawn behind her, splitting the room in half. Upper cabinets above a countertop

that holds medical books, disinfectant gel, and a telephone can be seen on the right of the screen. Dr. Naronha wears glasses and her hair down. You can see her name embroidered on her white lab coat in the head and shoulder shot, followed by the words, “Pediatrics, Hematology,” stitched after.

She explains Sharee’s symptoms as, *“The swelling is called dactylitis. In patients with sickle cell disease, it can occur in the first year of life and effect the hands and/or feet. It’s typically the first of the episodes of vaso-occlusive crisis. It is considered a marker of severe disease. I encourage families whose infants have dactylitis to start a medicine called Hydroxyurea.”*

“(Hydroxyurea is an) FDA-approved medication that increases the body’s production of fetal hemoglobin. This is the hemoglobin that infants produce before birth and it works better than the patient’s own sickle hemoglobin.”

“Hydroxyurea is safe in children as young as 9 months. When Sharee was an infant, hydroxyurea had not been standardly offered at her age. So, she started (using it) in high school.”

Dactylitis

Dactylitis can be the first manifestation of vaso-occlusive crisis.



Figure 4: Infant's hands suffering from dactylitis

Vaso-occlusive crisis:

- Acute pain
- Can occur without warning
- Pain described as sharp, intense, stabbing, or throbbing
- Pain often occurs in the:
 - Lower back
 - Legs
 - Arms
 - Abdomen
 - Chest
- Can be brought on by triggers

Hydroxyurea

- FDA approved
- Raises fetal hemoglobin expression
- Should be offered to children with SCD, HbS-beta-0-thalassemia starting at 9 months old
- Reduces pain crises & acute chest syndrome

Sharee and Combating Symptoms

The video shows Sharee facing the camera directly in a head and shoulder shot. She's wearing a red sweater and hoop earrings, with her hair held back by a headband. She's in front of her living room window, with the curtains drawn. You can see the front yard in the background with a neighbor's house opposite, partially obscured by trees.

“After my first bout of dactylitis, my parents were told to keep an eye for swollen joints, keeping me hydrated, and as warm as possible at all times.”

A photo that accompanies the video shows Sharee at 1-year-old.



Figure 5: Sharee at 1-year-old

The video continues with Sharee's hematologist, Dr. Suzie Naronha appearing in a patient examining room. A dividing curtain is halfway drawn behind her, splitting the room in half. Upper cabinets above a countertop that holds medical books, disinfectant gel, and a telephone can be seen on the right of the screen. Dr. Naronha wears glasses and her hair down. You can see her name embroidered on her white lab coat in the head and

shoulder shot, followed by the words, “Pediatrics, Hematology,” stitched after.

Dr. Naronha says, *“In addition to excellent hydration, we recommend using warm compresses and anti-inflammatory medications like ibuprofen.”*

Home Pain Management

- Hydration
- Warmth
- NSAIDs

NSAIDs compared to Acetaminophen

NSAIDs and acetaminophen may not completely relieve pain in children with SCD, and overuse may lead to complications due to toxicity. NSAIDs are associated with mucosal bleeding; acetaminophen can cause permanent liver damage. Parents, caregivers - and patients as soon as they are able - should be educated and supported in efforts to record the dates, times and dosing of all products, including cold and allergy combination products that contain NSAIDs or acetaminophen.

Ibuprofen (Advil®), Motrin®)

- Indications:
 - Mild to moderate pain
 - Fever
 - Headache
 - JRA/JIA
 - OA; RA
- Metabolism: oxidation
 - Inhibitor of CYP2C9
- Onset of action: 30-60 min
- $t^{1/2}$: 2-4 hr
- Formulations:
 - Oral (tabs, caps, susp, drops)
 - IV (Caldolor®)

APAP (Tylenol®)

- Indications: pain and fever,
- Metabolism:
 - Mostly glucuronidation and sulfate conjugation (80-90%)
 - Oxidative metabolism via 2E1 & 1A2 → toxic metabolite (NAPQI)
 - Inactivated by glutathione
- With large doses, main route is saturated
- FDA not more than 325 mg of acetaminophen per dose in combination products (e.g. cold and flu medications such as Alka Selzer Plus, Mucinex, NyQuil.)

Sharee's First School Episode

The video shows Sharee facing the camera directly in a head and shoulder shot. She's wearing a red sweater and hoop earrings, with her hair held back by a headband. She's in front of her living room window, with the curtains drawn. You can see the front yard in the background with a neighbor's house opposite, partially obscured by trees.

“One of the most memorable crises that I first had was in second grade. My ankles started to hurt really bad and I could barely walk. I told my teacher and her response was, ‘What do you want me to do about it? Cut them off?’”

“When the school bus got to my drop off, I couldn't even stand up, I was in so much pain. My dad had to get on the bus and physically carry me off.”

A photo showing Sharee in elementary school accompanies the video.



Figure 6: Sharee at 5-years-old

A head and shoulders shot of Nurse Karen Parker can be seen. She's got shoulder length hair and wears a silver medallion necklace of a tree. Her white shirt has an ID badge in a plastic sleeve clipped to the neck of it. in an examining room. There's an adjustable padded exam table with disposable paper lining it behind her, raised to an upright sitting position. Behind her to the right and mounted on the wall is a combined ophthalmoscope and otoscope. To the immediate right of that on the wall is mounted a sharps disposal unit.

“A school nurse can communicate with teachers and staff about a child's needs and limitations. A teacher might not understand the seriousness of a child's condition and brush off symptoms. In Sharee's case, a trusting

relationship with her school nurse, who could assess her symptoms, provide early intervention, and communicate with Sharee's parents and doctors might've prevented the misunderstanding."

"It's very important that staff, teachers, and the nurse, be aware of the diagnosis, accommodations, and health history of a student with sickle cell disease, so if the child does have a crisis, or even just needs extra support, he or she can get help promptly."

"The school nurse has a vital role in creating an atmosphere of trust, collaboration, and serving as an advocate for the student throughout their school career."

Role of the School Nurse

- Communication with teachers and staff
- Assess symptoms, early interventions, open communication with other providers
- Trust, collaboration, advocacy
- If there is no school nurse...contact support
 - In states and localities that lack school nurses, teachers, bus drivers, and other school staff may benefit from instruction about common childhood conditions and diseases for which referral and treatment may be necessary. A local public health department, library, or pediatrician may be able to provide guidance. As a universal precaution, schools should educate children, parents, teachers and staff about procedures for any health crisis in any child and create systems for reporting and follow-up. In Sharee's case the bus driver would have known what to do and how to close the loop with the school on Sharee's severe pain episode. On-line, [NIH Medline Plus provides a basic overview of sickle cell disease.](#)

Sharee and Coping Skills

The video shows Sharee facing the camera directly in a head and shoulder shot. She's wearing a red sweater and hoop earrings, with her hair held back by a headband. She's in front of her living room window, with the curtains drawn. You can see the front yard in the background with a neighbor's house opposite, partially obscured by trees.

“When I was in elementary school, I remember going to the doctor’s often. My dad would bring me every three months to see my pediatrician and get my routine bloodwork done. I felt different because this eventually became second nature that was attached to my life. I didn’t know of any other kids around me who had to go to their doctors as much as I did. So, this made me question, ‘Why did I get this?’”

A photo of Sharee at 8-years old accompanies the video.



Figure 7: Sharee at 8-years-old

The video continues with Sharee's hematologist, Dr. Suzie Naronha appearing in a patient examining room. A dividing curtain is halfway drawn behind her, splitting the room in half. Upper cabinets above a countertop that holds medical books, disinfectant gel, and a telephone can be seen on the right of the screen. Dr. Naronha wears glasses and her hair down. You can see her name embroidered on her white lab coat in the head and shoulder shot, followed by the words, "Pediatrics, Hematology," stitched after.

"This is not an uncommon question. Sometimes it's hard to help kids understand that sickle cell disease is not their fault."

Psychosocial concerns

- Children with SCD may feel different or isolated
- They may blame themselves for this disease
- They need support to learn healthy coping skills and to build self-esteem

Sharee and Triggers of Pain Crises

The video shows Sharee facing the camera directly in a head and shoulder shot. She's wearing a red sweater and hoop earrings, with her hair held back by a headband. She's in front of her living room window, with the curtains drawn. You can see the front yard in the background with a neighbor's house opposite, partially obscured by trees.

"One time, when I was eight years old, I was at a water park just having fun running around with some friends. I remember going to change into my dry clothes, but I felt a tingling sensation in my joints. When we got into the car to go home, I told my mom it felt like fire. She said, 'You probably were running in cold water and not drinking enough, right?' She gave me a syringe of liquid ibuprofen, which didn't help because the pain got worse, and she rushed me to the ER."

A photo of Sharee at 9-years-old-old accompanies the video.



Figure 8: Sharee at 9-years-old

The video continues with Sharee’s hematologist, Dr. Suzie Naronha appearing in a patient examining room. A dividing curtain is halfway drawn behind her, splitting the room in half. Upper cabinets above a countertop that holds medical books, disinfectant gel, and a telephone can be seen on the right of the screen. Dr. Naronha wears glasses and her hair down. You can see her name embroidered on her white lab coat in the head and shoulder shot, followed by the words, “Pediatrics, Hematology,” stitched after.

“It is not uncommon for pain crises to develop after certain triggers, such as cold-water exposure or dehydration. Increasing hydration, providing

warmth, and giving a dose of ibuprofen can sometimes prevent a trip to the ER.”

“However, pain sometimes cannot be controlled at home. In the ER, we recommend a protocol including intravenous fluids, ketorolac, which is a strong anti-inflammatory agent, and intravenous morphine for several doses. Sometimes three to four doses alleviate the pain enough that the patient can then manage it at home.”

Triggers of Pain Crises

- Cold and cold-water exposure
- Dehydration
- Stress
- Infection

Pain crises are a vicious cycle. Hypoxic conditions lead to cell sickling, then erythrocytes rupture, which decreases the oxygen carrying capacity of blood, that then starts the cycle all over again.

- Once the process starts, it progresses rapidly
- Patients can decompensate quickly, within a few hours:
 - Dangerously low erythrocyte counts
 - Will lead to death if not treated promptly

ER Protocol

- IV fluids
- NSAIDs
- Ketorolac (Toradol)
 - NSAID used for the short-term relief of moderately severe pain
 - Should not be used for longer than 5 days
 - First doses of ketorolac by intravenous or intramuscular injection in a hospital or medical office.
 - May continue treatment with oral ketorolac.
 - Stop taking oral ketorolac on the fifth day after receiving ketorolac injection.
- 1-4 doses of IV narcotics

- Morphine²
 - Used as an analgesic
 - Is a potent agonist at the mu opioid receptor
 - Multiple routes of administration
 - Metabolized by hepatic cytochrome P450 enzymes and glucuronidation into a number of active metabolites
 - Excreted by renal elimination
 - Chronic use may cause renal disease in sickle cell patients
 - May cause respiratory depression and death
 - May lead to tolerance, dependence, and addiction
 - May cause constipation and urinary retention
 - Discontinuation may lead to withdrawal symptoms
 - DEA Schedule II drug

Sharee's Diary

The video shows Sharee facing the camera directly in a head and shoulder shot. She's wearing a red sweater and hoop earrings, with her hair held back by a headband. She's in front of her living room window, with the curtains drawn. You can see the front yard in the background with a neighbor's house opposite, partially obscured by trees.

“Starting in about the fourth grade, I've kept a diary. I didn't write in it every day, but I did try to keep track of times when something important happened or when I had specific experiences with my sickle cell disease.”

“One of the first was when I realized that I was different from people who didn't have sickle cell disease. Because I had to go to the doctor's a lot of times and take medicines and have lab tests.”

The video continues with Sharee's hematologist, Dr. Suzie Naronha appearing in a patient examining room. A dividing curtain is halfway drawn behind her, splitting the room in half. Upper cabinets above a countertop

² [Gupta M et al. \(2015\) Morphine for the treatment of pain in sickle cell disease. Sci World J doi: 10.1155/2015/540154 PMC4306369](https://doi.org/10.1155/2015/540154)

that holds medical books, disinfectant gel, and a telephone can be seen on the right of the screen. Dr. Naronha wears glasses and her hair down. You can see her name embroidered on her white lab coat in the head and shoulder shot, followed by the words, “Pediatrics, Hematology,” stitched after.

“Frequent follow-up with the hematologist is necessary so that I can educate the families and the patients as they grow older about ways to keep themselves healthy.”

“Patients with sickle cell disease should be monitored regularly to detect complications. Patients with sickle cell disease have chronic anemia. Many are able to participate in sports, but those with severe sickle cell disease may have more severe anemia, leading to decreased stamina. Some activities can actually precipitate a pain crisis.”

Sharee and Physical Education

The video shows Sharee facing the camera directly in a head and shoulder shot. She’s wearing a red sweater and hoop earrings, with her hair held back by a headband. She’s in front of her living room window, with the curtains drawn. You can see the front yard in the background with a neighbor’s house opposite, partially obscured by trees.

“We got our curriculum today in class and it was all our requirements to graduate. I already have to walk quite a ways from class to class, but now I’m forced to participate in physical activities that my body may not be able to handle.”

“I’m in this alone. I’m not sure if anyone will take my word for it, but I have to talk to someone. I have to speak up and get my doctors involved. My parents can no longer help me on my medical journey. I’m just worried if I make my illness known to one, it’ll be known to all. Graduating now for me will be more than greatest test scores and homework assignments.”

A photo of Sharee at 15-years-old accompanies the video.



Figure 9: Sharee at 15-years-old

A head and shoulders shot of Nurse Karen Parker can be seen. She's got shoulder length hair and wears a silver medallion necklace of a tree. Her white shirt has an ID badge in a plastic sleeve clipped to the neck of it. in an examining room. There's an adjustable padded exam table with disposable paper lining it behind her, raised to an upright sitting position. Behind her to the right and mounted on the wall is a combined ophthalmoscope and otoscope. To the immediate right of that on the wall is mounted a sharps disposal unit.

“Providing care and support for high school-age students with sickle cell disease draws heavily on school nurses ability to advocate for these students. In many schools, gym class is required for graduation, so Sharee’s inability to participate is a concern.”

“Because prolonged exercise could trigger a sickle cell crisis, intervention by the school nurse is appropriate. The nurse can work with Sharee’s doctors, family, and the school to create a 504 plan. Such a plan specifies accommodations to ensure success and access to academic learning environments when the student has an identifiable disability.”

“In this case, the plan might outline rest periods, access to water, activity restrictions, and other accommodations that would allow Sharee to successfully meet graduation requirements. The school nurse can work with students to clarify how widely to share their diagnosis with school officials and teachers, and can serve as an advocate for the student in negotiating accommodations.”

504 Plan

- Overall accommodations
- Academic
 - Extra time for tests
- Physical activity
 - Rest periods, access to water
- Allow for advocacy and communication

Sickle cell anemia is a qualifying disability under the federal Individuals with Disabilities Education Act. Schools that receive federal funds, including all K-12 public schools and universities, are [required to provide accommodation plans for students with sickle cell disease](#) regardless of the whether or not the school has a nurse on staff.

Sharee and Combating Implicit Bias

The video shows Sharee facing the camera directly in a head and shoulder shot. She’s wearing a red sweater and hoop earrings, with her hair held back by a headband. She’s in front of her living room window, with the curtains drawn. You can see the front yard in the background with a neighbor’s house opposite, partially obscured by trees.

“Out of all the experiences in my life, whether they be fun, traumatic, upsetting, or exciting, I’ll always remember the way I felt. I lost count of

the times I've been in a crisis beyond a pain scale of ten but still had to make sure I was well groomed. 'Why?' you ask? Because if I even remotely look like I'm an addict, I will definitely be treated like one."

"Emergency 101: all sickle cell patients are only there for drugs. When did this get added to Tintinalli study guide? The stigma behind this has made my life more complicated than one can imagine. There are no 'two truths and a lie.' It is true up until told to shut up by our parents. It is true I've waited ten plus hours in tears to be triaged, behind others with every visit."

"This is why we as a community choose to suffer in silence, because our screams for relief will be ignored anyway."

The video continues with Sharee's hematologist, Dr. Suzie Naronha appearing in a patient examining room. A dividing curtain is halfway drawn behind her, splitting the room in half. Upper cabinets above a countertop that holds medical books, disinfectant gel, and a telephone can be seen on the right of the screen. Dr. Naronha wears glasses and her hair down. You can see her name embroidered on her white lab coat in the head and shoulder shot, followed by the words, "Pediatrics, Hematology," stitched after.

"Unfortunately, this is an all-too common experience for people with sickle cell disease, both anecdotally and in the literature. In general, racial and ethnic minorities are less likely to receive standard of care treatments due to the implicit or subconscious bias of medical providers."

"Greater recognition of, and better education about implicit bias at the individual, institutional, and societal level may make these experiences less frequent over time."

What is Implicit Bias?³

- Bias that is subconscious and is accumulated over a lifetime of experience
- Can override conscious beliefs
- Can lead one to unknowingly act against one's accepted values
- Influenced by role modeling as much as by overt "teaching"
- Affects decisions and behavior towards others
 - Not limited to race

Implicit bias

- Affects minorities disproportionately
- Leads to worse medical care for victims of bias
- Strategies to recognize and combat implicit bias are needed

Sharee and Her Most Recent Crisis

The video shows Sharee facing the camera directly in a head and shoulder shot. She's wearing a red sweater and hoop earrings, with her hair held back by a headband. She's in front of her living room window, with the curtains drawn. You can see the front yard in the background with a neighbor's house opposite, partially obscured by trees.

"About two weeks ago, I began to have pain while I was at a restaurant. Even though I was wearing a long-sleeved blouse and a sweater, the air conditioning triggered a crisis. I started hydrating and took some ibuprofen, then decided to go home. But the pain was severe enough, I told my friends to take me to the ED. I got dilaudid for the first time and I didn't really like the way it made me feel."

"I was hospitalized for five days and the hospital pharmacist met with me right before discharge, and I was scheduled to see my hematologist."

³ Steed J. Mayo Clinic News Network. Mayo Clinic; 2015

Clinical Encounters

Inpatient Pharmacist

Learning Objectives

- List potential non-pharmacologic pain management interventions
- Identify common opioid counseling points
- Describe the goals for pain management interventions

The video opens to a scene of Sharee sitting on the side of her hospital bed, across from an inpatient pharmacist, Kate Juba, PharmD. Kate sits in a chair scooted closer to the hospital bed, about five feet away from Sharee. The rolling tray table used to serve patients meals in bed is pulled up in front of Kate. On it lie some papers and a couple pens to make notes.

Kate wears a black top with a dark purple pullover sweater on top. She wears glasses and has chin length dark brown hair, tucked behind her ears. Sharee wears a burgundy sweat shirt and has her hair pulled back with a black fabric headband.

Kate reaches to shake Sharee's hand. *"Hi Sharee, my name's Kate. I'm one of the discharge pharmacists at the hospital. Do you have a couple minutes to chat with me about your medication?"*

"Yes," Sharee nods.

"So, today I see that you're going to be going home on oxycodone, ten milligrams. And you can take this every four hours as needed for pain. What advice did the doctor give you about how specifically to take this?"

"He told me to take it as needed every four hours," says Sharee.

"Okay."

"Usually, they show me a chart, and it just tells me the last time I took it. So, 'as needed' is how they explained to take it from now on," Sharee says.

“Okay. So, you mentioned a chart. When you go home, do you write down when you take your pain medicine and how you’re feeling?”

“Sometimes,” Sharee says. “Especially if I’m headed towards a crisis, I remember the last time I took my dose.”

“Okay,” Kate nods. “That’s a really great thing to do, especially because then you can take that information when you go to your doctor’s appointments or if you come into the hospital. That really gives the provider some kind of background on what’s been happening recently, so they can work with you and figure out what’s going to be the next best step.”

“So, one of the things I noticed,” Kate continues, “is the dose that you’re on going home is a little bit higher than the dose that you came in on. So, I noticed that your dose prior to admission was five milligrams every four hours. And now you’re going to be going home on ten milligrams. And it’s really common after somebody has a crisis that in that period when your body is healing and moving forward from that, that you might need a higher dose for a period of time. Do you have a doctor’s appointment set up soon?”

“I do.” Sharee responds. “In about three days I’ll be meeting with my primary doctor.”

“Okay,” says Kate. “That’s perfect, because at that time your primary will work with you. The goal is to get you back down to the dose you were on before the hospital. So, it’s a little bit of a moving target, depending on how you’re feeling. So, what did the doctor tell you to expect with this new dose that you’re going home with?”

“They tell me to expect being dizzy. I may get some stomach aches, but also constipation.”

“So, those are all really common side effects any time you take oxycodone or any other opioid medication.” Kate tells Sharee. “Because you’ve been on this before, I would expect that your body kind of develops a tolerance and gets used to that feeling really tired or having an upset stomach. So,

usually those get better with time unless you have a lot of big dose increases. Then your body may have those side effects again.”

“You mentioned constipation,” Kate continues. “Unfortunately, that’s one side effect your body doesn’t get used to.”

“One side effect I do want to talk about...it’s really rare, but serious is slowed breathing,” Kate tells Sharee. “So, sometimes if patients take a lot of medication, or if they take doses that are very high, they may have slowed breathing. Again, it’s rare but serious, and one thing that’s really important to know about that is feeling really, really tired is going to show up before that slowed breathing.”

“So, one thing to share with your family or when you’re off at school in a few months, if you have roommates, is if they notice that you’re starting to get really tired, make sure you don’t take any other pain medicine. And they’re going to want to call the doctor. If they notice that the tired has kind of moved where you’re only breathing less than eight times, ten times a minute, then they want to call 911.”

“In terms of things to expect, again, once you take a dose of the oxycodone, it should start working in about thirty minutes. Most patients notice it’s at its most effective after about an hour. For most people it lasts about four hours.”

“What has your doctor recommended that you do if pain isn’t well controlled with the oxycodone?”

“Well,” Sharee begins, “I usually don’t turn to oxycodone until I’ve tried a lot of other things like meditating or breathing. Sometimes even just sitting in my room listening to my music, just to relax myself.”

“Okay,” says Kate. “Those are all great things to do, and I think it’s really important that you keep doing those things. One thing that’s really important with pain medication is it’s one part of your pain management plan. I often think about each of the different interventions and things that we do have some increase, but when we add them all together, then that’s where we really start to see big changes.”

“As much as I wish that we could have you pain free, our goal with the medication is try to keep you as functional and active as possible. We’d like you more comfortable so you’re able to get better quality rest at night. Again, it’s only one part of the puzzle.”

Sharee nods in agreement with Kate.

“How do you store your medications? How do you store your oxycodone?”
Kate asks.

“I don’t have a pill case, but the doctor did say that I should try to keep those in there. Other than that, I just keep them in a medicine cabinet.”

“Do you have any pets at home or younger kids that come to your house, maybe family members?”

“I do have a dog,” Sharee says. *“He actually helps me when I’m in pain by putting his head on my knee. But yeah, just in a medicine cabinet is where I keep them.”*

“Okay,” says Kate. *“So, one thing that’s really important with oxycodone is because it is a medication that has potential for diversion and has a very high street value is that you want to make sure you keep it in an area that’s not accessible to everybody that comes into your house.”*

“Any other questions?” Kate asks Sharee.

“No, I’m just ready to go home.”

“I’m sure,” Kate says sympathetically. She reaches over to shake Sharee’s hand. *“It was a pleasure meeting you.”*

“You too,” says Sharee.

“I hope you are feeling better soon, and I hope you’re able to get some rest when you get home.”

“Thank you.”

Dosage Overview

- Higher dose at discharge
- Primary Care visit in 3 days to re-evaluate
- Goal: Reduce dosage
- Side Effects: Dizziness, stomach ache, constipation
- Serious potential side effect: Slowed breathing (fatigue is early sign)
 - If breaths less than 8 to 10 per minute call 911

Timing of Effect of Oral Opioid Dose

- Initial effect: 30 minutes
- Maximum effect: 60 minutes
- Total duration: 4 hours

Adjunctive Therapies Prior to Opioids

- Meditating
- Breathing
- Sitting listening to music
- Relaxing

Interventions

- Good function
- Activity level
- Comfort
- Sleep

Medication Storage

- Pill case
- Keep inaccessible to others

Hematologist

Learning Objectives

- Understand some of the concerns with opioid use in sickle cell disease
- Be familiar with the transition needs of young adults with sickle cell disease

Sharee and Dr. Suzie Noronha sit opposite each other across a desk in an office. Dr. Noronha sits with her back to the office door, which is closed. Behind Sharee, you can see a flat screen TV mounted to the wall. To the left of the women is a white board. Currently, the white board is wiped clean. Dr. Noronha has an open laptop on the desk in front of her. Sharee has a notebook in front of her and holds a pencil, ready to take notes.

Sharee wears a purple sweater and a bracelet on her left arm that compliments the sweater. She's got her glasses on and her hair pulled back by a headband. Dr. Noronha also wears glasses and a light purple scarf on top of her white clinician's coat. Her shoulder-length hair is loose.

Dr. Noronha begins, *“Sharee, it’s really nice to see you coming out of the hospital. I know this was a long admission for you. So, I’d love to hear about what happened and what brought you to the emergency room. And then once we hear about that, remember this is our final visit for transition before you go off to college.”*

Sharee says, *“I went to a movie theater. It was really cold in there. So, I had to leave a bit early. I should’ve been better prepared; I didn’t bring a jacket or a sweater. So, I left, started the usual things: took some ibuprofen, hydrated, drank a lot of water, took my pain medicine, even got in my bed to try to get warm and just relax a little bit, but it just got worse. I had to go to the ED.”*

“What did you do to relax,” asks Dr. Noronha.

“I just put on some music, made sure all the lights were off. I turned the heat on of course, but nothing really worked.”

“What did they do for you in the ED?”

“The usual,” Sharee says. *“Oxygen and fluids. But this time they gave me something called dilaudid. Morphine wasn’t working anymore and I don’t know why. It definitely was a different feeling. More euphoric...I guess I’m just a little nervous.”*

“What about the dilaudid made you nervous?”

“Well, I hear a lot of times that sickle cell patients can get addicted to the medicines, and this was much stronger than morphine. That just makes me a little worried.”

Dr. Noronha responds, *“So, I’m really glad that you’re thinking about these issues, especially because you’re going to be off without family support in college. So, it’s important to understand how these medicines affect your body.”*

“Now, I do want to make a distinction between addiction and dependence,” Dr. Noronha continues. “Dependence is something that can happen with these sort of medicines; they’re called opioid medicines as you know. Your body kind of gets used to them. That’s called tolerance. We sometimes see after years of using the same opioid medications, your body no longer responds to it as well and you just don’t get the same sort of pain relief.”

“So, one response to it is to increase the dose, but sometimes we have to switch to a different type of opioid medicine, which is what they did, it sounds like, in the emergency room. Because of those changes in how your body responds to it, it also can lead to something called dependence. So, if you’re on an opioid medicine for a long time, your body sort of becomes dependent on it, and when you stop it too quickly, it can lead to uncomfortable symptoms that we call withdrawal symptoms.”

“Addiction is different. So, addiction is a situation where your body starts to crave it and it impairs your ability to function in life because your body and your mind are so focused on getting this medication.”

“I’ve never seen you be in that situation,” Dr. Noronha tells Sharee. “The fact that you’re cognizant of that possibility will help me and your doctors to stay safe and use these medications wisely.”

“Okay,” says Sharee. “So, they sent me home with some. I’m concerned because my parents aren’t going to be in charge of my medicine because I’m going off to college. So, what do I do now?”

“So, you do have a visit set up with the pharmacist after you see me,” says Dr. Noronha. “The pharmacist is going to help you taper your medication. So, one of the things that opioid medications do is set up a sort of dependence, where if you are on it for a long time and then you stop too soon, you can develop these uncomfortable symptoms that we call withdrawal.”

Sharee nods and takes notes.

“So, if you taper your medicine from a high dose to a low dose,” continues Dr. Noronha, “it can help prevent those symptoms.”

Sharee checks her notes and says, *“Physical therapy. I did that a couple of times in the hospital. Do you think I should keep doing that?”*

“I think it’s a really good idea,” Dr. Noronha says. “We use physical therapy in the hospital because the pain was keeping you in bed for many days in a row, and when you don’t move, your muscles become weaker. That just makes the pain worse and last longer. So, that’s why we use physical therapy in the hospital.”

“I do think it’s a really good idea to use as an outpatient. So, that way you can learn stretches and exercises that are appropriate for your level of fitness, to help maybe prevent some of these crises. So, if we use physical therapy on an outpatient basis, maybe your future pain crises will be less severe.”

“Okay,” says Sharee.

“There are other ways to manage your pain besides opioid medication. And then, I was wondering if you would be interested in seeing an acupuncturist.”

Sharee looks skeptical. She plays with her pencil before saying, *“Okay, wait. Acupuncture...isn’t that with needles and stuff?”*

“It is with needles,” says Dr. Noronha. *“I know you’ve had a lot of experience with needles and it’s not your favorite. I can understand that. Acupuncture uses a very special type of needle that doesn’t cause pain. I don’t know a whole lot about it, but it seems to potentially be effective in reducing pain. It might be helpful to go and talk with the acupuncturist and see what he has to offer.”*

“I think you’ll be pleasantly surprised. It’s a technique that’s been used in Asian countries for centuries.”

“I’ll give it a try,” says Sharee.

“So, let’s move to the transition part of our visit,” says Dr. Noronha. *“Have you made a decision about where you want to go?”*

“I haven’t just yet, but I have been accepted to my top three choices. I just haven’t picked one just yet.”

“Okay. I know they’re all pretty far away?” asks Dr. Noronha.

“Yeah,” says Sharee.

“Okay, over the years we’ve had a lot of transition visits to help prepare you for that change. So far, I think you’re becoming independent in terms

of calling for appointments and asking for medication refills. You've been pretty good about getting your lab work to monitor your blood counts on the hydroxyurea."

"Because I will not be able to see you," Dr. Noronha tells Sharee, "that means we're going to have to find doctors in your area who you will be able to see on a regular basis and also be able to call in an emergency."

Sharee makes another note. *"Okay."*

"Are you going to have a car?" Dr. Noronha asks.

"Probably not. I'll probably stay on campus," Sharee says. *"I did have a question."*

"Okay."

"How are they going to know anything about me? My charts? My info? What if I need a blood transfusion like last time? I don't know how that's going to get to them."

"That's a really good point," Dr. Noronha says. *"That is why I want to know which college you're eventually going to go to. So that way you and I can research, 'Okay, how do we contact the university health center?' If you don't have a car, that's most likely going to be your most accessible medical clinic. But you also need a hematologist. So, someone like me, but who takes care of college students and adult patients. Hopefully someone who is familiar with sickle cell disease."*

“If you needed a transfusion, it would generally be the hematologist who would help to arrange that. Once we establish who those people will be, then I will be sure to send them all of your information with a complete summary of what type of sickle cell disease you have, what medications you’re on, what sort of complications you’ve experienced, and especially what you do to manage pain. I want them to be familiar with that.”

Sharee nods in agreement.

“That’s especially so if you need to go to the emergency room or be admitted there,” Dr. Noronha says. *“I want them to know what protocol works for you.”*

“I guess taking away everything and being a part of PEDs so long, I just want to make sure I spread the word and make sure that we take care of ourselves and make it an issue to really get to know our medical team,” Sharee says.

“I think you will be successful,” Dr. Noronha tells Sharee.

“Thank you,” Sharee responds.

Sharee's Usual Home Care

- Usual Trigger: Cold
- Home management routine:
 - Ibuprofen
 - Hydrated
 - Pain medication
 - Relaxation
 - Music
 - Lights off
 - Heat

Emergency Department Management

- O₂
- Fluids
- Morphine ineffective, changed to hydromorphone⁴ (Dilaudid®)
 - Sharee is concerned about addiction

⁴ Hydromorphone

- Synthesized from morphine
- Higher lipid solubility than morphine and crosses the blood-brain barrier more easily than morphine
- Oral bioavailability is very low. Usually used in hospital setting where it is given by i.v. administration
- Not metabolized by cytochrome P450 enzymes. Metabolized by glucuronidation to hydromorphone-3-glucuronide
- Excreted by renal elimination
- May cause respiratory depression and death
- May lead to tolerance, dependence, and addiction
- May cause constipation and urinary retention
- Discontinuation may lead to withdrawal symptoms
- DEA Schedule II drug

Tolerance/Dependence vs. Addiction

- **Tolerance:** Body becomes tolerant and requires increased dose or rotation to another medication
- **Dependence:** Body becomes physiologically dependent; withdrawal symptoms if discontinued too quickly
- **Addiction: *Craving*;** focus on getting more medication

Tolerance/Dependence can occur with chronic use of an opioid even if taken as prescribed, but does not by itself constitute addiction.

Managing Medications

- Pharmacist will discuss tapering to prevent withdrawal

Other Therapies

- Physical Therapy
 - Inpatient and outpatient benefits
- Acupuncture

Transition

- New providers
- How will they know about Sharee?

Contact University Health Services

- PCP
- Hematologist

Information Transfer to New Providers

- Type of Sickle Cell Disease
- Medications
- Complications
- Pain Management Protocol

Outpatient Pharmacist

Learning Objectives

- Describe the purpose of folic acid treatment in patients with sickle cell disease.
- Understand the purpose and common side effects of hydroxyurea treatment in patients with sickle cell disease.
- Recall frequency of monitoring with hydroxyurea

Sharee and Angela, the outpatient pharmacist, face each other across a high-top table in an office. Sharee already sits in a tall chair at the table when Angela introduces herself and reaches to shake Sharee's hand. *"Hi Sharee, I'm Angela, the pharmacist that works here with Dr. Noronha,"* she says. Angela wears gray pants and a yellow button up shirt with thin, gray, vertical stripes. Her blonde hair is cut in a bob and she's carrying a sheaf of papers in one hand. Sharee sits ready to take notes with an open notebook and a pen in front of her on the table. She's wearing glasses and a salmon-colored top with cut out embroidery on the sleeves. She has her hair pulled back in a ponytail.

"Hi," she says in response to Angela.

“I was asked if I could come in and talk to you about your medications if you still have time,” Angela tells Sharee.

Sharee responds, *“Yeah.”*

Angela sits in the elevated seat across from Sharee at the high-top table.

“So, Sharee, now that you’re going to be in the adult clinic, I just wanted to take some time to review your current medications, in particular the folic acid and the hydroxyurea to make sure you’re comfortable independently managing those as you move on into college.”

“Okay,” says Sharee.

“So, for the folic acid, can you tell me how you’re currently taking that?”

“Yeah,” Sharee says. *“Just once a day, one milligram.”*

“Beautiful,” says Angela. *“And, what did the doctor tell you about that medication? Did they tell you how it works, or what to expect from that?”*

“Not really,” Sharee responds. *“I just know I’ve been taking it and they want me to take it every day.”*

“Take it every day,” Angela repeats as she notes it. *“Okay, so it is used to help prevent anemia. So, when you’re very tired, that’s kind of a sign of anemia. So, they use the folic acid because patients that have sickle cell disease, they make red blood cells quicker than other patients, and their body needs the folic acid to make those red blood cells. So, that’s why you take that supplement.”*

Sharee nods in understanding.

“For the hydroxyurea,” Angela continues, *“can you tell me currently how you’re taking that medication?”*

“Yeah, I’ve been taking that for about four years now. Two thousand milligrams, once a day.”

“Beautiful,” says Angela. *“And do you know what that medication is for?”*

“I do know that it prevents the pain that I have,” says Sharee.

“Okay,” says Angela. *“Are there any specific side effects that you’ve discussed with the doctor about what to expect with that medication?”*

“She said I could get some upset stomach. Other than that, not really.”

“That’s true,” Angela says. *“So, it can cause some upset stomach. Sometimes some nausea can go along with that. One of the big things with hydroxyurea is it can actually cause mouth sores.”* She points to her cheek. *“So, good oral hygiene, making sure you’re brushing your teeth is very important with that medication just to prevent some of those mouth sores. So, you want to make sure you’re brushing and flossing twice a day regularly with that.”*

Angela continues, *“Other than helping with the crises, it also helps with some of the complications that can arise for patients that have sickle cell disease. What that does is it kind of helps the cells that normally for sickle cell patients, they kind of make a ‘C’ shape.”* She demonstrates with her hands the shape of a capital ‘C.’ *“They stick together and they clump, and*

that's what causes some of those crises. But patients who are on hydroxyurea, their cells stay puffy and round so they bounce off of each other and don't stick. So, that one of the reasons you take that medication."

"Okay," says Sharee.

"It looks like you've been on it for a long time. You said you've been on that dose for several years. Are you getting lab work with that medication still?"

"Yes, quarterly," says Sharee.

"Beautiful," responds Angela.

"That would be what I would expect if you've been on that dose for a while; that you would still want to check in quarterly. As you're heading towards college, one of the things that would be important is to touch base with university health services."

"Hydroxyurea can cause some skin discoloration," continues Angela. "So, it's really important to use sunscreen with this medication." Sharee takes note of this. "Especially if you end up someplace nice and sunny," Angela says. "You do want to wear sunscreen with it, and wear sunglasses when you're outside to prevent some of the skin damage that can occur with it." Sharee nods and adds to her notes.

"We talked about your lab work," Angela says as she crosses off the item on her list. "A little personal question, but it is really important...has your doctor talked to you about contraception while you're on hydroxyurea?"

“Not yet,” says Sharee. “She just mentioned that if I do, it’s probably something I shouldn’t take.”

“So, yes and no,” says Angela. “So, for patients on hydroxyurea, we want to make sure that you’re using a good method of contraception. Especially going away to college, there will be whole new experiences that are out there for you. We want to make sure you had something you could take reliably every day at the same time, or something you wouldn’t have to think about, like an implant. Because for patients who are on hydroxyurea, it’s really important to plan a pregnancy carefully around that medication. We wouldn’t want you to become accidentally pregnant on the hydroxyurea because that could be harmful for you or the baby. So, when you get to that point, we want to make sure you’re thinking about contraception and planning ahead.”

“Okay,” says Sharee.

“Other questions about the hydroxyurea that you might have for now?” Angela asks.

“Not about the hydroxyurea,” says Sharee. “I do want to talk about pain medicine.”

“Sure,” says Angela. “Absolutely.”

“Will I be on that forever?” asks Sharee.

“So, it looks like you’re taking just an immediate release pain medication in addition to some of the over the counter ibuprofen doses. So, the over

the counter ibuprofen I'd expect to be in your arsenal against sickle cell disease kind of on a long-term basis."

"For the pain medication, the oxy, looks like you're having a crisis recently, a little bit higher dose than you normally had been on. I'd expect as you get farther away from your crisis, your dose could come down. Then, if you experience another crisis, you may need to go back up. So, for the oxycodone, I'd expect as you age, and as you go through time, you may need more, and then you may need less. Is it something I'd expect you to have in your back pocket over the long term? Yes. Same dose? Not likely though."

"Also, how do you determine how much pain medicine I should take versus someone else taking pain medicine?" Sharee asks.

"So, there's a couple ways to do that," Angela answers. "So, you can look at, kind of your body and how do your kidneys work, how's your liver work. So, that will help weed out some of the choices for medications. And then, what's worked for you in the past. Often, if something's worked well in the past, it can work well in the future. And vice versa. If you tried something that didn't work, or you had bad side effects from, we'd be less likely to pick that agent."

"That can be different for all sorts of patients. It may be different for you, someone else that has sickle cell disease, or even a third person. So, it really is tailored towards you. And the dose is tailored towards you as well."

“Okay,” notes Sharee. She jots it down in her notebook. “That’s all I have so far.”

Angela says, “Okay, some parting thoughts I would have for you, again as you’re moving towards the adult clinic and managing your meds independently, and also going away to college...I briefly mentioned touching base with university health services before. So, every college will have kind of a health system within the campus. So, it’d be important for you to reach out to them early so that they would know that you’re there. Maybe keep a list of medications that you could give to them in case you were to have any issues or concerns. It’s better to touch base early.”

“I’d also want you to be mindful if there were any changes. Any side effects that we talked about that you hadn’t been experiencing before that kind of cropped up that were new. I’d want you to again, reach out to them so they can help you either manage that and triage it, or reach back to the providers here.”

“Okay,” agrees Sharee.

“Again, having those plans early and often will make it smoother for you,” Angela says. She reaches across the table to shake Sharee’s hand again. “So, it was a pleasure.”

Sharee smiles and shakes Angela’s hand. “You, too.”

“And I look forward to seeing you back in the clinic before you head off to college,” Angela says.

“Thank you,” says Sharee.

Folic Acid⁵ Purpose and Instructions

- Patient is advised to take 1 mg (1 tablet) by mouth once daily
- Helps prevent anemia
- Patients with sickle cell disease make red blood cells quicker than other people
- Folic acid helps the body build red blood cells
 - If patients are feeling tired or weak they should contact their doctor

⁵ Folic Acid

- In patients with Sickle Cell Disease (SCD), the RBC count is lower than normal because sickled cells usually die after 10 to 20 days, in contrast to 120 days for normal RBCs. Because of high cell turnover, folate stores are often depleted.
- Folic acid replenishes the depleted folate stores necessary for erythropoiesis. Folic acid supplementation is well established in the treatment of chronic hemolytic anemia.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2730092/>

- Replacement needed due to accelerated cell destruction
 - Recommended for adults with SCD, women considering pregnancy & patients with SCD + chronic hemolysis
 - 1 mg by mouth once daily

Kennedy, Fung, Kawachak, et al. Red blood cell folate and serum B12 status in children with sickle cell disease. *J Pediatr Hematol Oncol* 2001; 23:165-69.

Hydroxyurea's Purpose

- Who's a candidate⁶ for treatment with hydroxyurea?
- Patient is advised to take full dose 2000 mg by mouth once daily
 - Dose is based on patient's weight
- Hydroxyurea reduces the frequency that patients experience sickle cell crises, such as:
 - Pain crises or vaso-occlusive crisis (VOC)
 - Acute chest syndrome
 - Priapism (pain prolonged erection in male patients)

⁶ Who is a candidate for Hydroxyurea?

- In adults with sickle cell anemia (SCA) who have greater than or equal to three moderate to severe pain crises associated with sickle cell disease (SCD) during a twelve-month period, initiate treatment with hydroxyurea
- In adults with SCA who have sickle cell-associated pain that interferes with daily activities and quality of life, initiate treatment with hydroxyurea
- In adults with SCA who have a history of severe or recurrent acute chest syndrome (ACS), initiate treatment with hydroxyurea
- In adults with SCA who have severe symptomatic chronic anemia that interferes with daily activities or quality of life, initiate treatment with hydroxyurea
- In infants 9 months of age or older, in children, and in adolescents with SCA, offer treatment with hydroxyurea regardless of clinical severity to reduce complications (eg, pain, dactylitis, ACS, anemia) related to SCD
- In adults and children with SCD who have chronic kidney disease and are taking erythropoietin, add hydroxyurea therapy to improve anemia
- In persons with HbS β -thalassemia or HbSC who have recurrent SCD-associated pain that interferes with daily activities or quality of life, consult an SCD expert for consideration of hydroxyurea therapy

Yawn BP, Buchanan GR, Afenyi-Annan AN, Ballas SK, Hassell KL, James AH, Jordan L, Lanzkron SM, Lottenberg R, Savage WJ, Tanabe PJ, Ware RE, Murad MH, Goldsmith JC, Ortiz E, Fulwood R, Horton A, John-Sowah J. Management of sickle cell disease: summary of the 2014 evidence-based report by expert panel members. *JAMA*. 2014 Sep 10;312(10):1033-48.

- Hydroxyurea has also been shown to decrease hospitalizations

Hydroxyurea Common Side Effects

- Gastrointestinal (GI) side effects:
 - Upset stomach
 - Nausea
- Mouth sores possible (practice good oral hygiene)

Skin Effects of Hydroxyurea

- effects (less common): Patients should use sunscreen and wear sunglasses
 - Hair loss
 - Lightening

Hydroxyurea Mechanism of Action

- Prevents clumping of red blood cells by reducing deformity

Hydroxyurea

- Mechanism of action: increase presence of fetal hemoglobin and slow down cell destruction
- Onset: 4-12 weeks
 - Response seen in lab parameters (HbF and MCV) @ 8 weeks
 - Peak response & benefits beginning @ 40 weeks
- Precautions: teratogenic (causes birth defects)
 - Contraception recommended for both male and female patients during and after treatment
- Administer w/ folic acid
 - folate deficiency may be masked by hydroxyurea

Yawn BP, Buchanan GR, Afenyi-Annan AN, Ballas SK, Hassell KL, James AH, Jordan L, Lanzkron SM, Lottenberg R, Savage WJ, Tanabe PJ, Ware RE, Murad MH, Goldsmith JC, Ortiz E, Fulwood R, Horton A, John-Sowah J. Management of sickle cell disease: summary of the 2014 evidence-based report by expert panel members. *JAMA*. 2014 Sep 10;312(10):1033-48.

- Hydroxyurea is an oral medicine that has been shown to reduce or prevent several SCD complications.
- This medicine was studied in patients with SCD because it was known to increase the amount of fetal hemoglobin (hemoglobin F) in the blood. Increased hemoglobin F provides some protection against the effects of hemoglobin S.
- Hydroxyurea was later found to have several other benefits for a person with SCD, such as decreasing inflammation.

<https://www.nhlbi.nih.gov/health-topics/sickle-cell-disease>

Hydroxyurea Monitoring

(approximate time frame):

- Before starting hydroxyurea
- When hydroxyurea is started
 - Every month
- With changes in dose
 - Decrease: every week
 - Increase: every 2 months
- Once stable dose is reached (no changes in dose or labs)
 - Every 2-3 months

Hydroxyurea and Contraception

1. Both men and women should have safe sex practices while on hydroxyurea
 - Men should wear latex condoms (if not allergic)
 - Women should use a consistent method of birth control (oral contraceptives, implants, etc.)
2. Patients taking hydroxyurea should plan ahead before trying to have children as it can cause harm to an unborn child.
 - Contact your doctor about planning a pregnancy as the medication should be safely discontinued

Pain Medication

- Oxycodone IR (Immediate Release)
- OTC ibuprofen
 - Need for medication life-long
 - Dosages will vary
 - Specific medications will also vary

Checklist for Sharee's Transition

- Contact campus health service
 - Inform them of your SCD
- Keep current list of medications
- Monitor side effects/symptoms

Consultation with Psychologist

Learning Objectives

- Identify how engagement with behavioral health can promote positive psychosocial adjustment for individuals with sickle cell disease.
- Describe how the biopsychosocial and cognitive-behavioral frameworks can promote effective pain management and healthy medical coping and acceptance.
- Discuss aspects of transition from pediatric to adult medical care.

Sharee and Dr. Cohen sit across from each other in office armchairs. A small round coffee table rests between them, off to the side. A notebook and a travel coffee mug lay on top of the table. A potted tree-like plant adorns the corner to the right of Sharee's chair. The light from a completely round window behind the left of Dr. Cohen's chair bathes them both. Both Sharee and Dr. Cohen hold clipboards and pens in their laps.

"Hey, Sharee. Good to see you again."

"You too," says Sharee.

"So, you're about to move to college and do the transition from pediatric world to the self-care world. So, two big transitions coming up."

"Right," agrees Sharee.

"So, I wanted to take today's time to review some of our work together over the years. How does that sound?" Dr. Cohen asks Sharee.

"Sounds good."

"Great," says Dr. Cohen. *"So, let's talk a little about the biopsychosocial model and how it's helped you to kind of frame and navigate pain crises, medical coping, identity, things like that."*

Dr. Cohen points to the clipboard he holds in his lap and gestures towards Sharee's identical clipboard.

“So, if we look at our fancy sheet here, we’ve got the biopsychosocial model, which looks at biology, your physical constitution, psychology, thoughts and feelings, emotions, as well as the social context in which you live. Social factors, so, life, love, family, friends, school, work. So, all of those things kind of combine to make you, you.”

“In addition to the biopsychosocial model, there’s also the idea of lifestyle hygiene. So, eating, drinking, sleeping, physical activity. How have those factors played into your sickle cell profile?” Dr. Cohen asks Sharee.

“It’s like I always have to plan in my head for more than just one thing. Like not wearing a jacket, being super cold led me to being in the hospital. So, for just that one moment, not caring about wearing a coat.”

“And that one moment then cascades across all the other parts of you, the biology, the psychology, the social factors,” Dr. Cohen makes a scooping motion with his hands to show all the things he mentioned act together in tandem. *“So, I think that when you have taken care of yourself, exercising, getting to the gym, that’s helped to motivate you to put the effort in to put the other things together. So that in general, it helps your overall health and well-being.”*

“I also want to review...do you remember the triangle? The cognitive triangle?”

“Yes,” says Sharee.

“Yeah,” says Dr. Cohen. *“Thoughts, feelings, actions or behavior, all tied together. So, they’re all tied together so they can interact and affect each other. So, having really difficult thoughts, they can cascade and impact your feelings and your behavior. If you change some of those thoughts or are aware of some of those thoughts or feelings, then you can kind of change how your day goes, your behavior goes, and over all how your medical profile tends to play out.”*

“So, there’s the thoughts, feelings, and behavior,” Dr. Cohen says as he gestures in the shape of a triangle in the air, each point punctuated with the

words he describes. *“In the middle of it is the big ‘B’ in terms of your body, your somatic profile, your sickle cell presentation at any given time.”*

“There’s a good chunk of unpredictability about your medical profile, your sickle cell condition. And at the same time, are there some things that you can control?”

“Yeah, I can definitely keep warm and keep myself hydrate,” Sharee says. “I can make sure I take my medications. But also trusting my medical team and taking control of what I do have control over. Wearing a coat, making sure I get rest, just remembering that I’m more than just sickle cell.”

“So, one, you’re more than just sickle cell,” Dr. Cohen agrees. “And two you’re more than just your pain. We’ve talked before about the idea that the pain is pain, but suffering is optional. Meaning your pain is real, but the amount of suffering is adjustable. Meaning you can actually have a direct part, a direct role, in how much pain you experience aside from medical intervention, aside from medication.”

“So, in the past when you had a pain crisis, or significant stress that might then lead to a pain crisis, I recall that you would kind of hold on and then push through. Sound about right?”

“Yeah,” agrees Sharee.

“Yeah, and so tell me more about that in terms of remembering or not remembering to do things,” says Dr. Cohen.

“Well, as a kid,” Sharee begins, “you don’t really think about what you’re doing to cope with it. But I did have my mom and dad, who helped coach me, so to speak, as to how to handle it.”

“Yeah, you had your family as supports and reminders as well as the medical team that you could reach out to. And if you didn’t reach out to the medical team, we would follow you and catch you, which the pediatric world is really good about doing.”

“Right,” says Sharee.

“So, how are things going to be different moving into the adult world?” Dr. Cohen asks Sharee.

“Well, I won’t have my parents there with me, you know, twenty-four-seven. So, now it’s just me and I have to come up with a way to not rely on everyone else but myself on how to deal with the thoughts and the actions.”

“I would agree, but I would also push back a bit,” says Dr. Cohen. “I would agree in that, yes, there’s much more of you center stage here. In terms of managing your medical stuff and your life. Then there’s also the idea that you and I have talked about fairly frequently over the years. So, what’s your thought about when we say goodbye as you go off to college?”

Silence stretches for a few seconds as Sharee ponders her answer.

“I’m ready,” she responds.

“Yeah, what else?” prompts Dr. Cohen.

“I’m nervous.”

“Ready AND nervous,” Dr. Cohen reinforces. “And, have you had a medical team?”

“Yeah, for all my life,” Sharee says.

“Yeah. Have you found your new PCP?”

“Not yet.”

“Have you found your new sickle cell specialist?”

“No.”

“Have you found your new psychologist or therapist?”

“No.”

“Yeah, so helpful or not helpful to find those things?” Dr. Cohen asks.

“Helpful.”

“What’s going to happen if you don’t connect to resources when you go off to college?”

“That’s not going to look well or end well,” Sharee says.

“Yeah. Where are you going to go for care?”

“The ED, which is not a good idea.”

“Yeah. So, you’ve been accepted to several colleges, which is awesome.”

“Thank you,” Sharee says.

“And when you get there, what do they have at every college that’s going to be helpful?”

“University health services,” Sharee answers.

“Right. And I know many different medical team members, including me, we’ve talked to you about that piece. So, I think that that’s going to be a really important go-to for you to find primary care, to find specialty care for sickle cell disease, to find therapy. And I think that it would be helpful as you make that transition to connect to all those services. Then you can figure out later if you need therapy or not, or someone to talk to.”

“So, I’m really excited for you, Sharee, and I think we’ve talked about a lot in the past. I look forward to you kind of moving ahead full steam with your future.”

“Thank you, Dr. Cohen.”

“So, good luck in college, all right?”

“Thanks.”

Transitions

- Academic: High School to College

- Medical: Pediatric to Adult Self-Care World

Role of Psychology for Individuals with Sickle Cell Disease

- Non-Threatening Description of Role
- "I look for pain patterns and triggers, and ways to help you develop coping skills"
- Empathy
- "Life is hard enough, let alone living with a pain-related chronic medical condition"
- Normalization
- "This would be hard for anyone in your shoes"
- Validation
- "Your pain is real"
- Psychoeducation
- "Pain is multifactorial" / Biopsychosocial Model / Gate Theory of Pain
- Skill Building
- "There are evidence-based, non-pharmacological practices and interventions to help you live a more engaged, value-based life"
- Positive / Corrective Emotional Experience
- To promote engagement and adherence

Engagement Model

- Goals
 - Enhance life engagement, despite pain
 - Increase independent functioning
- Assumptions
 - Limit pain, not eliminate pain
 - Pain profile may or may not improve
- Signs of progress
 - Increased functioning
 - Enhanced coping
 - Improved self-efficacy

The Biopsychosocial Model

Lifestyle

- Sleep
- Diet
- Hydration
- Exercise

Biological

- Physical health
- Sex
- Pain modulation
- Pubertal development

Psychological

- Individual beliefs
- Mood / affect
- Anxiety / fear
- Coping

Social

- Culture
- Socioeconomic status
- School / work environment
- Social / peer interactions
- Parental / family factors

Linking Biopsychosocial Model and Lifestyle Hygiene

- "I always have to plan in my head" (*for lifestyle needs*)
- "Like not wearing a jacket and being super cold" (*landed me in the hospital*)
- "One moment of not caring" (*can cascade into a negative health cycle*)

Cognitive Triangle

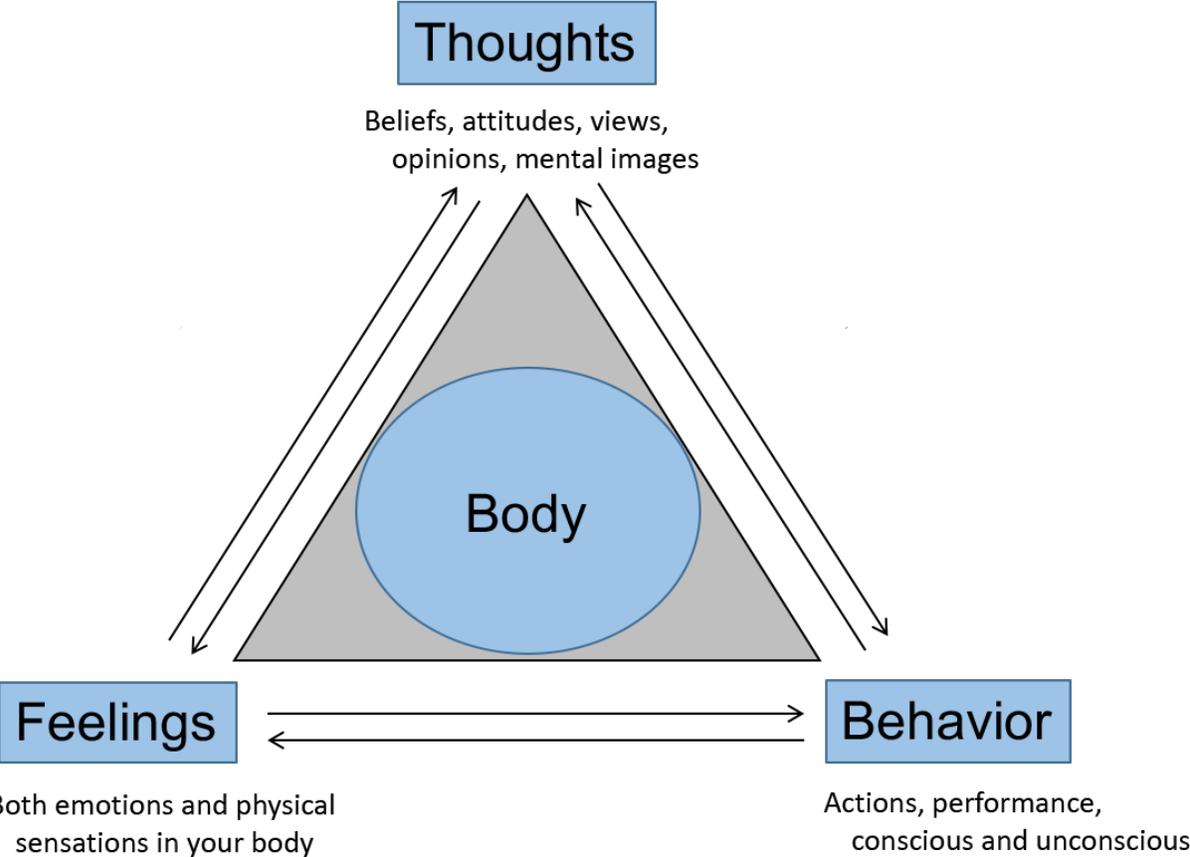


Figure 10: Cognitive Triangle

CBT Paradigm

Cognitive Behavioral Therapy (CBT)

- Intervention to promote healthy coping, engagement, and functioning
- Consider referral when:
 - Difficulty accepting or adapting to living with sickle cell disease
 - Limited range of tools for pain / stress management
 - Lifestyle changes have not been effective or patient has had difficulty implementing changes
 - Adherence challenges with medical regimen
 - Avoidance of engagement with life activities (e.g., school, work, family, social)
 - Family / friends Enable Maladaptive Behavior

CBT: Core Characteristics

- Thoughts, feelings, behaviors = interconnected
 - Make changes to thoughts and behavior that can affect positive mood and overall change
- Assumption that most emotional and behavioral reactions are learned
 - Therapy goal = help patients unlearn unwanted reactions and learn new ways of responding
- Emphasis on current behavior
- Based on "rational thought"
 - Facts, not assumptions
- Targeted and time-limited
 - Care can be episodic
- Structured and directive

- Homework is a core feature

Control

Control What You Can Control

- "Keep warm and hydrated" (*lifestyle*)
- "Take medication" (*adherence*)
- "Trust medical team" (*support*)
- "get rest" (*lifestyle*)
- Remembering I am more than sickle cell" (*identity*)

Self-Identity

Beyond medical condition and pain

1. "You are more than just your sickle cell disease"
2. "You are more than just your pain"
 - Pain is pain, but suffering is optional
 - Pain is real, but the amount of suffering is adjustable

Coping with Pain and Stress in the Past

- "Hold on and push through" pain and stress
- "Don't really think about what you're doing"
- Reliance on parental coaching / support
- Reliance on pediatric medical team to follow up

Coping with Pain and Stress in the Future

- "It is just me. I have to come up with a way not to rely on anyone else but myself"
- Self-reliance includes using available supports

Thoughts and Emotions Regarding Transition

What are Sharee's thoughts as she goes off to college?

- "I am ready and I am nervous"

Ambivalence is normal

Supports for Transition

Have you found your new...

- PCP?
- Sickle Cell Specialist?
- Psychologist or Therapist?

What If you do not connect to resources when you go off to college?

"Where will you go for care?"

- "The ED, which is not a good idea"

College Resources

- University Health Service
- Primary Care
- Specialty Care
- Psychotherapy

Consultation with Physical Therapist

Learning Objectives

- Describe the role of the physical therapist, as part of an interdisciplinary team, in treating individuals with chronic pain.
- Describe examples of exercises that may be prescribed to target multisystem involvement, specifically cardiopulmonary or musculoskeletal, resulting from SCD.
- Explain the importance of diaphragmatic breathing during exercise and times of stress.

Sharee and Linda Riek sit across from each other in an office with a flat screen TV mounted to the wall above their heads. They face each other with a small, round coffee table in between them. On it lie a clipboard, a bottle of water, and a discarded koozie. A walker with a rubber hose draped across the front of it rests behind Sharee's chair. Sharee's wearing an orange long-sleeved top with brighter orange athletic shorts. Linda wears black pants and a purple long-sleeved shirt. Both women wear glasses. Linda's shoulder-length hair is down while Sharee's hair is pulled back into a bun.

“Hi Sharee,” Linda begins. “My name is Linda. I’m one of the physical therapists and I hear congratulations are in order on your upcoming graduation. You’re headed off now to school somewhere, right?”

Sharee smiles. *“Right. I don’t know where yet, but somewhere.”*

“Okay. So, one of the things that I’ve been hearing is that you might need some physical therapy when you leave here. So, I wanted to talk to you a little bit about what physical therapy could offer you.”

“So, physical therapists are movement specialists. They help people of all different abilities and all different ages, all through the lifespan.” Linda makes a sweeping gesture with her arm to demonstrate the timeline of an entire life. *“So, one thing that they will help you do is really increase movement, increase your function and your quality of life.”*

“Any specific exercises I should be doing?” asks Sharee.

“Sure, so we can address two main areas I think would be a great way to start. So, we would do a full comprehensive evaluation first. But, a couple of big areas that I think we should be able to target,” Linda says as Sharee picks up the bottle of water to take a sip, *“would be targeting the avascular necrosis in your knee as well as the other joints in your body by using a stationary bike. Or a stationary bike that has an arm component to that. And some light resistive exercises. That would be a great way to start help you just get moving.”*

“The other thing that we could focus on are some pulmonary exercises. So, you mentioned to me that you’ve had some hospital stays.”

“Right,” responds Sharee. *“I’ve had acute chest syndrome a couple of times.”*

“So, sometimes after that you can have some restrictions in your lungs,” says Linda. *“So, these exercises would be perfect for you. They would be some postural exercises and also some breathing exercises. We’re specifically targeting the diaphragm.”*

Linda places a hand over her stomach, just below her ribs. *“All right, so first I’m going to have you just to put your hand on your stomach.”* Sharee complies. *“And when you breathe,”* Linda says, *“so, when you’re breathing in and out, and even just watching you breathe a little bit, where do you think that breathing is coming from?”*

“Is it from your hand, here,” and Linda motions to her hand on her stomach, the position Sharee mirrors right now. *“Or is it coming from your chest, up a little bit higher.”*

“Probably here,” Sharee says, placing her other hand on her chest.

“Yeah, so a little bit higher,” says Linda. *“What I want you to focus on is when you breathe in, okay, is that you’re going to feel your hand come out a little bit,”* and Linda mimes this with her left hand pretending to cradle her stomach out farther than it is with her right hand currently resting on it. She takes a deep breath. *“Okay, so in for about the count of two. And you really feel your hand move. And out for the count of four. So,”* Linda purses her lips to exhale slowly. *“You’re doing a great job,”* she tells Sharee.

“You’re using pursed lip breathing,” Linda says. *“So, in again for a count of two.”* They both steadily inhale at the same time. *“All right. I’m going to have you do one more thing for me.”* Linda moves her right hand from her stomach to her side, just where the ribs begin. She mirrors the placement with her left hand on her left side. Sharee copies her movement.

“This time, I’m going to have you put your hands on the side of your abdomen. And same thing; you’re still going to breathe in for the count of two and out for a count of four. Okay? Still through those pursed lips. You want to fully exhale.” Both Linda and Sharee practice breathing in for a count of two and exhaling through pursed lips for a count of four.

“All right. So, the next one that you’re going to do is called stacked breathing. Okay, so you’re going to take three puffs like you’re breathing in through a straw. One, and then build on that, two, three. So, you’re building three in and then you’re still going to do out through that pursed lip for the count of four.” Linda demonstrates taking three breaths almost as if she sips the air, without releasing any of it. After the third inhalation, she releases it for the four second count. Sharee mimics her successfully.

Linda pats her abdomen with her right hand. *“And you can still keep that reminder if you need to, on your abdomen while you’re doing that.”*

“Okay, so this is all diaphragmatic breathing, trying to expand your lungs a little bit more, trying to change those mechanics of your breathing so that your breathing is coming more from your abdomen and recruiting that diaphragm, rather than from the upper chest.”

“Okay,” says Sharee.

“So, these are all just breathing exercises, and we’ll figure out which ones are the best for you to start with at home. Really, the first one is just learning to use that diaphragm, putting your hand here,” and Linda places her right hand over her abdomen. *“In for the count of two, out for the count of four with the pursed lip breathing. And sort of the added benefit of it is I know that at time it can be a little be stressful, especially when you’re headed into the hospital. So, some of these breathing exercises can also be used for relaxation when you’re in a time of stress.”*

Linda gets up and moving to the walker behind Sharee, plucks the rubber hose band from its top bar and sits back in her seat. *“So, one of the next things I’m going to have you do is learn a postural exercise.”* She places the rubber hose on the table.

“So, one of the things that’s helpful when you’re doing some of these breathing exercises is also to be sitting up, and opening up that ribcage, rather than having the kind of closed in kind of ribcage.” Linda demonstrates the closed in kind of ribcage by hunching over, her shoulders bowed and her head tucked towards her chest. She then straightens back up in her chair.

“You want to be opened up,” she tells Sharee. *“So, one of the first things I’m going to have you do, without any kind of equipment or anything at all , is practice bringing your shoulder blades, not up,”* Linda demonstrates not shrugging when bringing the shoulder blades back, *“but together and down in the back. Okay, so you’re squeezing your shoulder blades together and down,”* she repeats.

Sharee copies Linda's posture of shoulder blades together and down in the back.

"Okay, so you know what I mean," Linda tell Sharee. Linda stands up and places her hand on Sharee's back to make sure her shoulder blades are in the correct positioning. *"So, you're going to do that for a count of three,"* she tells her.

"So, you're squeezing together and down, and not lifting up those shoulders. And you're going to hold that for a good three count. One one-thousand, two one-thousand, three one-thousand. And then relax."

Linda gives Sharee two foam colored handles attached to either end of the rubber hose band. Linda then pulls the middle of the band towards herself as she sits across from Sharee, stretching the band about three feet.

"You're going to pull your arms back, squeezing those shoulder blades down and back," Linda directs Sharee. Sharee holds the two foam handles with her arms bent at the elbow ninety degrees. She keeps her arms in the same bent positioning and rotates her shoulders back against the resistance of the rubber hose band.

"Don't let those shoulders come up in the air. Okay for the count of three. One, two, three."

"This is going to help with my breathing?" asks Sharee.

"It's going to help with your breathing, and your posture," affirms Linda.

“So, when your posture’s improved, then your breathing can be maximized,” Linda continues.

“Okay,” says Sharee.

Linda still holds the rubber hose band three feet away from Sharee, who brought her arms back to their initial position, grasping the foam handles attached to the rubber hose band.

“Now, another thing I’m going to have you do while you’re doing the exercises are adding in the breathing we just practiced,” says Linda.

“So, as you’re pulling the rubber band back, you’re going to take a nice breath in,” says Linda as she demonstrates inhaling. Sharee starts pulling the band back while mimicking Linda’s breathing technique. She pauses for the count of three.

“Then, when you bring the handles back towards me, you should exhale for a count of four.” Sharee does so, with pursed lips.

“Okay, again,” says Linda.

Sharee repeats the exercise. Once finished, she says, *“So, I did have a question. I’ve been dealing with chronic pain obviously all my life and I just notice sometimes I stay away from doing any exercises kind of less and less as I get older just because I’m afraid of hurting myself or causing a crisis.”*

“So, in general I think having a connection with a physical therapist will be wonderful for you, especially if you’re moving away. You can talk

about having a local physician or local dentist; you can also have a physical therapist that you establish a relationship with. When you feel that you need a little tune up even, or you've been to the hospital or you need to work on something, you can contact them. So, I think that would be great and I think a physical therapist is good as far as helping you to take an active role in your care. But they're one discipline of many, so you're going to have a whole bunch of health care providers that you have on your team."

Sharee nods in agreement. *"All right, thanks so much Linda."* She reaches to shake Linda's hand.

"You're welcome," says Linda.

What is a physical therapist?

- A movement specialist that treats people of all abilities to improve their function and quality of life across their entire lifespan.

Exercises for a patient with SCD

For patients with Avascular Necrosis⁸:

- Stationary bike with arm component
- Light resistive exercises

For patients with Acute Chest Syndrome⁹:

- Postural and breathing exercises to relieve lung restriction

⁸ Avascular Necrosis

- Caused by repeated disruptions in blood flow to the joint
- Usually found in adolescents and adults, not children
- Sickling in the bones of the hip, shoulder joints, knees, and ankles
- Decreased oxygen flow results in severe damage
- Symptoms:
 - Pain and problems with walking and joint movement

<https://www.nhlbi.nih.gov/health-topics/sickle-cell-disease>

⁹ Acute Chest Syndrome

- Caused by occlusion of blood vessels in the lungs
- Lungs can be deprived of oxygen causing tissue damage
- Often starts after a painful crisis
- Symptoms:
 - Pain
 - Fever
 - Shortness of breath
 - Cough

<https://www.nhlbi.nih.gov/health-topics/sickle-cell-disease>

Practicing Diaphragmatic Breathing¹⁰ with Pursed-Lip Exhalation

1. Hand on abdomen
2. Feel hand on abdomen push out with inhalation
3. Hands on sides to monitor movement for inhalation and exhalation

Stacked Breathing

- 3 puffs (short breaths)
- Exhale with pursed lips for a count of 4

¹⁰ CBT: Behavioral Techniques

- Evidence-based coping strategies that can decrease pain / stress experience
- Choose two or more coping strategies – practice daily and use as needed:
 - Diaphragmatic breathing
 - Progressive muscle relaxation
 - Mindfulness
 - Meditation

CBT: Behavioral Techniques – Diaphragmatic Breathing (DB)

- AKA deep breathing or belly breathing
- Basics
 1. **Lie down** (or sit comfortably) with knees bent and shoulders, head, and neck relaxed.
 2. **Place one hand on your upper chest and the other hand just below your rib cage.** This will allow you to feel your diaphragm move as you breathe.
 3. **Breathe in slowly through your nose** so that your stomach moves out against your hand. The hand on your chest should remain as still as possible.
 4. **Exhale through pursed lips** by tightening your stomach muscles and letting them fall inward as you exhale. The hand on your chest should remain as still as possible.
 5. **Practice 5 minutes at a time**, starting with 1-2 practice sessions per day.

Diaphragmatic Breathing

- Expands lungs
- Changes the mechanics of breathing

Diaphragmatic breathing can help relaxation at times of stress

Practicing Postural Exercises

- Sitting up, opening up rib cage
- Squeezing shoulder blades together and down
- Improving posture improves breathing

A physical therapist as part of the team

- Can help reduce fear through teaching and monitoring appropriate exercise
- Can be a motivator to take an active role in one's own care

Consultation with Acupuncturist

Learning Objectives

- Explain how an acupuncturist would assess and characterize sickle cell disease
- Be familiar with the current evidence base relating to acupuncture and sickle cell disease
- Describe the specific risks and adverse events associated with acupuncture

Dr. Ergil sits across from Sharee in an office with a long table that serves as a desk pushed up against the wall. Dr. Ergil is on the left while Sharee is on the right. Two posters showing pressure points on the human body from the anterior and posterior views hang on the wall between them. On the desk sit a lamp, a phone, and a laptop.

Sharee sits with her bottle of water next to her on the desk. She's wearing her glasses and dark gray sweatpants and a dark gray shirt with long black sleeves. Her hair is pulled back in a bun, held more securely in place with a black headband. Dr. Ergil wears a blue button-up shirt and has a short beard.

“So, Sharee, it's nice to meet you.”

“Thanks, you too.”

“So, I gather both your doctor and your physical therapist talked to you about acupuncture as being a possible thing to use.”

“Yeah, they said it would somehow help, pain-wise,” Sharee says.

“Okay. What I’d like to do today...I’ve looked over your notes a little bit and I’d like to ask you some questions about your pain situation and how you experience it.”

“Okay,” says Sharee.

“I’d like to do some traditional diagnostic techniques,” Dr. Ergil continues. “Take your pulse and look at your tongue a little bit. And then I’ll talk to you a little bit about what our plan might be. And I’d be really happy to answer any questions you may have about acupuncture and how it might be able to be helpful.”

“All right,” says Sharee.

Dr. Ergil says, “So, my understanding is that you can have pain almost anywhere?”

“Yeah,” Sharee agrees. “It doesn’t matter if it’s on Monday or Friday, pain can be in any joint at any time, even in my back. So, I’ve pretty much experienced pain throughout my whole body.”

“And is there any region of the body that you’re more likely to experience pain in?” Dr. Ergil asks.

“No, it depends on if it’s a severe crisis. The main part that I do have a lot of pain in sometimes is my knee because of the vascular necrosis. But other than that, it can vary.”

Dr. Ergil makes a note of this. *“And do you have any days that are pain free?”*

“Some days I do. Most days it’s a pretty typical day. Usually pain is brought on by dehydration or the cold, even stress. So, those three main trigger points are what cause the varieties of different pain.”

“How often do you have the severe crises?”

“I’ve been hospitalized, let’s see, countless times over the course of my life, but severe ones that sent me to the ED and ending up needing blood transfusion or hospitalization, I would say happen about at least four to five times a year.”

“Do you feel in general, warm or cold?” asks Dr. Ergil.

“I get cold easily. It can even be in the summertime and I’ll still prepare myself with a coat, sweater, or hoody.”

“So, you need to sort of dress in more of a warm way than anybody around you?”

“Yeah, especially if the AC’s on in any restaurant or public place, it definitely can cause a pain episode.”

“Can you just characterize the pain for me? Like when it’s severe?”

“Yeah,” says Sharee. *“It’s hard to put in words, but it’s excruciating. I wouldn’t wish it on my worst enemy. It can range from feeling like I’m being cut from the inside out. Sometimes it feels like I’m being beat with a*

two by four, and other times it can be a dull throbbing pain that just won't go away."

Dr. Ergil takes more notes based on Sharee's description of her pain.

"So, before we move on are there any other pain areas we haven't talked about? We talked about your knee a little bit. I'm clear that it's sort of throughout the body. Are there any other areas that are significant for you?"

"Yes, I have had acute chest syndrome in the past quite a few times which affects my breathing and does cause pain within my chest and my ribs."

"And does that necessarily cause you to wind up at the ED?"

"Yeah, definitely. If I start to feel pain within that area, going back to the home medications, if that doesn't help I don't play around with it if it affects my breathing and causes pain."

"So, will you even try the home meds or go straight to the ED?"

"I'll try the home meds but if it doesn't get better I go right to the hospital."

Dr. Ergil notes this. *"How often do those occur,"* he asks.

"Not as often as another crises with the rest of my body, but it definitely has occurred and will most likely will occur soon."

"So, what I'd like to do now is do a couple of aspects of the exam that are just very traditional in Chinese medicine. I'm going to take your pulses,

and you can relax, I'm going to get a pillow for you to put your hands on,"
Dr. Ergil says as Sharee responds by holding out her wrists to him.

"We're going to take some time to look at your tongue and what I look at there is the coating of the tongue and also its overall coloration."

Dr. Ergil collects a red pillow that he rests on Sharee's lap. He has her lay both wrists on the pillow with her palms facing up as he takes her pulse.
"When I'm doing this, Chinese medicine is very interested in the movement of blood in the body, which is one of the reasons that we actually think that, well, we know, critically and from research, that you can change the behavior locally of blood circulation."

"So, when we take the pulse like this, there are some very old ideas about what each finger position can tell me about different regions of the body,"
Dr. Ergil says. He has the first three fingers of each hand lightly pressing into the outside part of Sharee's wrists, just below her palm.

"Also, how you are constitutionally, that is, what your overall state of health is. The pulses that you're presenting with today, we would call them 'string-like' typically."

"Okay," says Sharee.

"Which we associate with, I mean it can be a healthy pulse. It can be a pulse that's present when there's pain. It in some positions signals that the body is working a little harder than it needs to be."

Once Dr. Ergil finishes taking Sharee's pulses, she relaxes her arms with her hands folded in front of her on the pillow. He has her open her mouth so he can shine a flashlight on her tongue to check it.

"And, go ahead and curve your tongue up towards the tip of your mouth," he instructs her. Sharee complies.

"Okay, great. Thank you so much," says Dr. Ergil. Sharee closes her mouth and he clicks off the flashlight.

"So, what we're seeing here a little bit, the fur, or the coating on the tongue is a little thick. So, we associate that typically with some degree of internal dampness, the concentration of fluids. There's some redness near the tip and some small speckles. That we associate with a little heat in the upper body, depending on precisely what other things are going on."

"In a sense, you have how you are as a person. Your shape, your form, your physiology. And then you have this disease process as well. So, one thing that I may see in your tongue may not be directly related to these other processes."

"Okay," Sharee says.

"And then your tongue is a little scalloped on the sides."

"Okay, and do you think acupuncture could actually decrease the level of pain when I do go through those episodes?" Sharee asks.

“From what I’m seeing, reading, and communicating with folks, that sounds like in crisis, acupuncture would probably be a very useful thing to have on board.”

“Wow,” says Sharee.

“It also looks as if having sort of semi-regular acupuncture visits might give you a lower frequency. You are actually, from my little review of the literature, sound like your situation is very well controlled. Right? You have pain-free periods. Your ED visits, I think you said four a year?”

“Right,” agrees Sharee.

“From my understanding, that’s really good,” says Dr. Ergil. “So, would acupuncture make a difference to you personally? That we don’t know. Could it be helpful? And again, I want to be careful with how I say this. Most of the literature is in relation to crisis.”

“Okay.”

“However, there is a strong suggestion for people who are looking at this that ongoing intervention, like management with acupuncture might actually reduce the frequency of crises and reduce some of the on-going discomfort as well, without medication, which is an exciting idea potentially.”

“It is,” agrees Sharee.

The Road Ahead

Senior Year

A video shows Sharee facing the camera directly in a head and shoulder shot. She's wearing a red sweater and hoop earrings, with her hair held back by a headband. She's in front of her living room window, with the curtains drawn. You can see the front yard in the background with a neighbor's house opposite, partially obscured by trees.

Sharee addresses the viewer directly.

“As you can see, I got a lot of advice from my pediatricians about transitions to adult care. In addition to what I observed, I now attend a support group, and this is what I've been waiting for: to learn from others who have the same experiences I have.”

“As I build my team of providers at college, this will be an important part of my transition. My name is really Sharee, and I really do have sickle cell disease. I hope this project has allowed you insight on more than one scale, but this is not the makeup of my life story like I thought it was. No one will ever understand the physical pain of this disorder, but they may be willing to listen. No more masks, no more hiding. Let sickle cell disease become a testimony of resilience and awareness when you speak of it.”

“I love life, and life loves me. To the ones we've lost, this is for you.”

Appendix

Pathophysiology of Sickle Cell Disease

Learning Objectives

1. Define intrinsic hemolytic anemia and how it relates to sickle cell disease.
2. Describe the pathophysiology and genetics associated with sickle cell disease.
3. Describe vaso-occlusive crisis, avascular necrosis, and acute chest syndrome.

Intrinsic Hemolytic Anemia

- Inherited
- Abnormal genes lead to abnormal erythrocytes
 - Fragile or malformed, do not function correctly
 - Destroyed more easily
- Types
 - G6PD Deficiency
 - Sickle Cell Anemia
 - Thalassemias
 - Aplastic Anemia

Sickle Cell Disease

- Mutation¹¹ in one of the 146 amino acid molecules in a beta-globin chain leads to production of abnormal hemoglobin (hemoglobin S, HbS)
- Under hypoxic conditions, the beta chains link together
 - Form stiff rods that are sharp and spike-like
 - RBC becomes crescent-shaped
- RBCs rupture easily and dam up small vessels
 - Can cause extreme pain and loss of circulation

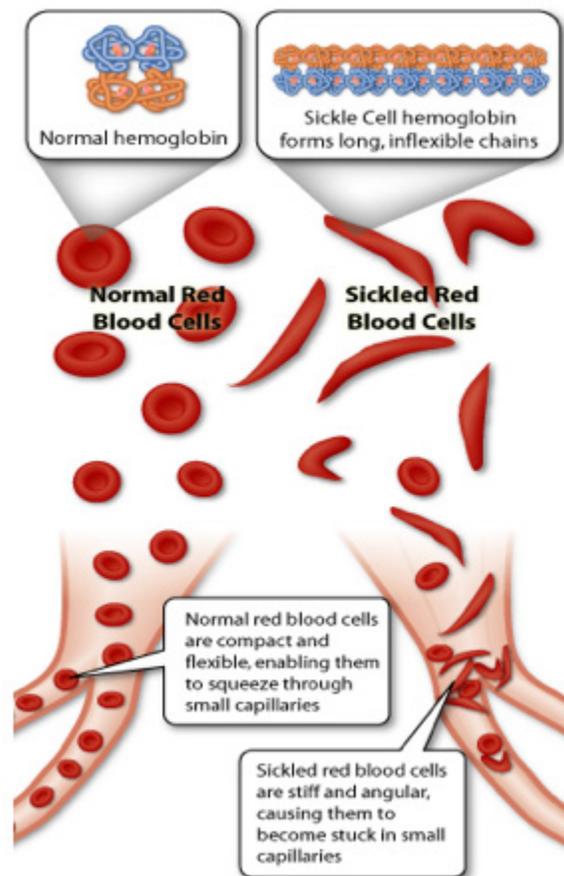


Figure 11: Normal vs. Sickle Cell Hemoglobin

¹¹ <https://ghr.nlm.nih.gov/condition/sickle-cell-disease#genes>

A Vicious Cycle

Pain crises are a vicious cycle. Hypoxic conditions lead to cell sickling, then erythrocytes rupture, which decreases the oxygen carrying capacity of blood, that then starts the cycle all over again.

- Once the process starts, it progresses rapidly
- Patients can decompensate quickly, within a few hours:
 - Dangerously low erythrocyte counts
 - Will lead to death if not treated promptly

Vaso-occlusive Crisis¹²

- Acute pain
- Can occur without warning
- Pain described as sharp, intense, stabbing, or throbbing
- Pain often occurs in the:
 - Lower back
 - Legs
 - Arms
 - Abdomen
 - Chest
- Can be brought on by triggers

Crisis Precipitation

High altitudes, rigorous exercise, and hypothermia all precipitate a vaso-occlusive crisis in a patient with sickle-cell disease.

Of a particular note with high exertion: can lead to rhabdo and renal failure.

¹² <https://www.nhlbi.nih.gov/health-topics/sickle-cell-disease>

Triggers¹³ for Vaso-occlusive Crisis

- Illness
- Changes in temperature
- Stress
- Dehydration
- High altitude

Avascular Necrosis¹⁴

- Caused by repeated disruptions in blood flow to the joint
- Usually found in adolescents and adults, not children
- Sickling in the bones of the hip, shoulder joints, knees, and ankles
- Decreased oxygen flow results in severe damage
- Symptoms:
 - Pain and problems with walking and joint movement

¹³ <https://www.nhlbi.nih.gov/health-topics/sickle-cell-disease>

¹⁴ <https://www.nhlbi.nih.gov/health-topics/sickle-cell-disease>

Acute Chest Syndrome¹⁵

- Caused by occlusion of blood vessels in the lungs
- Lungs can be deprived of oxygen causing tissue damage
- Often starts after a painful crisis
- Symptoms:
 - Pain
 - Fever
 - Shortness of breath
 - Cough

¹⁵ <https://www.nhlbi.nih.gov/health-topics/sickle-cell-disease>

Managing Implicit Bias

Learning Objectives

- Define implicit bias.
- Describe the association between implicit bias and patient outcomes.
- Enumerate the frequency of pain crises and life expectancy of patients with sickle cell anemia.
- Based on the epidemiology of sickle cell anemia, the characteristics of Sharee's neighborhood and the racial distribution of physicians and sickle cell anemia patients, describe the likelihood that implicit bias might occur in her health care.
- List at least 2 of Sharee's experiences that illustrate potential implicit bias.
- Briefly describe what you might do to recognize and address implicit bias in your own practice.

Sickle Cell Disease in the US: Understanding the Disease Context

Sickle cell anemia is a deadly and painful disease ¹⁶with variable coverage in US health care professional training programs

- Mortality
 - Average life expectancy is 42 years in males and 48 years in females
- Pain crises
 - 2/3 of patients experience chronic pain with acute events occurring multiple times throughout a year
 - Frequency and severity of pain are variable

¹⁶ Platt OS, et al. New England Journal of Medicine. 1994; 330(23):1639-44,

Wally R, et al. Annals of Internal Medicine. 2008; 148(2): 94-101

Sickle Cell Disease(SCD) in the US: Context for stigmatization

- Most US healthcare providers are White. Most US Sickle Cell Disease patients are Black or Hispanic.
- According to the CDC¹⁷, about 100,000 Americans are affected with Sickle Cell Disease
 - Occurs in about 1 out of every 365 African-Americans
 - Occurs in about 1 out of every 16,300 Hispanic-Americans
- The opioid epidemic has increased stigmatization of patients with SCD, because the pain is "invisible" and patients need pain medication urgently during crises

Sharee's Hometown Demographics¹⁸

- Median age: 31.3 years
- Median household income: \$31,684
- Poverty rate: 32.8%
- Non-English speakers: Spanish and African languages
- Majority of residents are African American

Sharee's Hometown Provider Characteristics

- Demographics
 - Providers mostly White
- Academic medical center is immediately adjacent to high poverty areas of the city
 - In primary care, most patients are from minority groups and live in poverty

¹⁷ Castillo-Page L. Association of American Medical Colleges; 2016

Sickle Cell Disease: Data & Statistics [Internet]. Center for Disease Control and Prevention. CDC; 2016

¹⁸ Rochester, NY [Internet]. DataUSA. Deloitte; 2014

What is Implicit Bias?¹⁹

- Bias that is subconscious and is accumulated over a lifetime of experience
- Can override conscious beliefs
- Can lead one to unknowingly act against one's accepted values
- Influenced by role modeling as much as by overt "teaching"
- Affects decisions and behavior towards others
 - Not limited to race

Implicit Bias: Effects on Health Care²⁰

- Health care providers act in accordance with implicit bias every day
 - Occurs more commonly when stressed or tired
- Can affect a provider's body language, generating subtle cues that lead patients to:
 - Lose trust
 - withhold information
 - fail to follow provider advice
- Reduce quality of care and can lead to medical errors
 - e.g., misdiagnosis via different lines of questioning
 - failure to treat pain
- Implicit bias rates among clinicians are same as in general population
- May affect treatment protocols/options or pain management
- May affect perception and decision making
- Most commonly targets racial/ethnic minorities
 - Can cause longer wait times
 - Less time spent "seeing" provider

¹⁹ Steed J. Mayo Clinic News Network. Mayo Clinic; 2015

²⁰ Wyatt R, et al. Achieving Health Equity: A Guide for Health Care Organizations. IHI White Paper. Cambridge, Massachusetts: Institute for Healthcare Improvement; 2016.

Implicit Bias: Effects on Patients²¹

- Non-white patients receive fewer cardiovascular interventions and fewer renal transplants
- African American women are more likely to die after being diagnosed with breast cancer
- In the US, life expectancy is lower in African Americans than Whites

Implicit Bias in Health Care²²

- Non-white patients are less likely to be prescribed pain medications (non-narcotic and narcotic)
- Patients of color are more likely to be blamed for being too passive about their health care

Examples from Sharee's Experiences

- She has learned to present to the ED only after careful grooming, so providers will not regard her acute pain episodes as drug-seeking behavior
- She is responding to past experiences of implicit bias by providers who make assumptions based on her race and appearance

Sharee's Other Experiences

- Providers may believe that acute pain episodes are caused by poor self-care. They may assume that her disease experience was completely within her control, regardless of her school, work, and personal life demands
- At school, teachers and classmates often are uninformed about SCD, and fail to make accommodations for her special needs

²¹ The national CLAS Standards [Internet]. U.S. Department of Health and Human Services, Office of Minority Health; 2018.

²² The national CLAS Standards [Internet]. U.S. Department of Health and Human Services, Office of Minority Health; 2018.

National Standards for Culturally and Linguistically Appropriate Services in Health and Health Care (CLAS Standards)²³

- These standards were developed by the Office of Minority Health, which works under the Department of Health and Human Services
- Goal: Provide effective, equitable, understandable, and respectful quality care and services that are responsive to diverse cultural health beliefs and practices, preferred languages, health literacy and other communication needs
- Can help reduce implicit bias and help better serve minority patients
- [Free, accredited online CE to support the implementation of these standards](#)

²³ The Joint Commission. “Quick Safety: Implicit Bias in Health Care.” April 2016.

Precautions for Provider Implicit Bias²⁴

1. Assume that implicit bias is operating at the health system and provider levels
2. Get the big picture: From what population are our patients? Providers?
3. Take social and personal inventories of unconscious bias (<https://implicit.harvard.edu/implicit/>)
4. Focus on the individual patient in their social context; avoid comparisons that may be unintentionally loaded with implicit bias
5. Recognize situations that amplify stereotyping and bias so common in healthcare
6. Apply the [National Standards for Culturally and Linguistically Appropriate Services in Health and Health Care \(CLAS Standards\)](#)
7. Stress, fatigue, high pressure environments, weak communication further weakened by illness, etc.
8. Use translators and teach-back methods.
9. Add another check to your care pathway: If I reimagine this patient as white and upper income would this diagnosis and therapy be consistent with evidence-based medicine?

Project Implicit

[This tool](#) is designed to help you reflect ways in which implicit bias may affect you.

²⁴ The Joint Commission. "Quick Safety: Implicit Bias in Health Care." April 2016.

Vaso-Occlusive Crises

Triggers for Vaso-Occlusive Crises

- Cold
- Dehydration
- Illness
- Overheating
- Stress

Home Pain Management: Medical

- NSAIDs
 - Ibuprofen
 - Naproxen
- Oral narcotics

Non-pharmacologic pain management

- Warmth
- Hydration
- Relaxation
 - Music
 - Journaling
 - Massage
 - Guided imagery
 - Biofeedback

Standard vaso-occlusive crisis management in the ED

- Intravenous fluids
- Oxygen
- NSAIDs
- Narcotics
- Admission if this regimen does not control pain

Transition process

- Transition: Period when patients transfer from pediatric to adult health system
- Young adults with SCD have a higher risk of death during the period of transition:
 - Lack of knowledgeable providers
 - Lack of continuity of care
 - Lack of awareness of personal health details
- Best outcomes with early, frequent discussion of transition and disease education
- Patients need to understand their personal health issues
- Independence with making appointments and requesting refills
- Following through on medical recommendations
- Complete transfer summary made available to receiving provider

Self-advocacy

- Important skill to learn during transition
- Especially important for patients with chronic illness/disability
- Can be nurtured by local support groups

Opioids For Treating Sickle Cell Pain

Common Opioids for Sickle Cell Pain²⁵

- Opioids most commonly used to treat sickle cell pain are:
 - Morphine
 - Oxycodone
- Hydromorphone (Dilaudid)
- Taking prescribed opioid medication for as little as 5 days is a risk factor for dependence or addiction

²⁵ <https://www.mayoclinic.org/diseases-conditions/prescription-drug-abuse/in-depth/how-opioid-addiction-occurs/art-20360372>

*Morphine*²⁶

- Used as an analgesic
- Is a potent agonist at the mu opioid receptor
- Multiple routes of administration
- Metabolized by hepatic cytochrome P450 enzymes and glucuronidation into a number of active metabolites
- Excreted by renal elimination
- Chronic use may cause renal disease in sickle cell patients
- May cause respiratory depression and death
- May lead to tolerance, dependence, and addiction
- May cause constipation and urinary retention
- Discontinuation may lead to withdrawal symptoms
- DEA Schedule II drug

²⁶ Gupta M et al. (2015) Morphine for the treatment of pain in sickle cell disease. Sci World J doi: 10.1155/2015/540154 PMC4306369

Oxycodone

- Used as an analgesic
- Is an agonist at the mu opioid receptor
- Good oral bioavailability
- Metabolized by hepatic cytochrome P450 enzymes into a number of active metabolites
- Some of its metabolites, such as oxymorphone, are more potent than oxycodone
- Excreted by renal elimination
- May cause respiratory depression and death
- May lead to tolerance, dependence, and addiction
- May cause constipation and urinary retention
- Discontinuation may lead to withdrawal symptoms
- DEA Schedule II drug

Hydromorphone

- Synthesized from morphine
- Higher lipid solubility than morphine and crosses the blood-brain barrier more easily than morphine
- Oral bioavailability is very low. Usually used in hospital setting where it is given by i.v. administration
- Not metabolized by cytochrome P450 enzymes. Metabolized by glucuronidation to hydromorphone-3-glucuronide
- Excreted by renal elimination
- May cause respiratory depression and death

- May lead to tolerance, dependence, and addiction
- May cause constipation and urinary retention
- Discontinuation may lead to withdrawal symptoms
- DEA Schedule II drug

Medical Marijuana

Learning Objectives

1. Differentiate between endogenous and exogenous cannabinoids
2. Identify the locations of CB1 and CB2 receptors and the primary functions they affect
3. Describe the pharmacology of the endogenous cannabinoid system

Definitions

- Cannabis
 - Substances derived from the Cannabis sativa plant
- Cannabinoid
 - Chemical compounds that act as agonists for cannabinoid receptors
- Phytocannabinoid
 - Compounds found in cannabis extracts
- Endocannabinoid
 - Endogenously existing neuromodulators

Endogenous Cannabinoid System

- Widespread localization throughout the body
- Regulates:
 - appetite, inflammation, pain, thermoregulations, sensation, metabolism, sleep, stress responses, mood, energy, and memory

Cannabinoid Receptors and Localization

CB1 Receptors: Neuromodulation	CB2 Receptors: Immunomodulation
Prefrontal cortex	B cells
Hippocampus	Macrophages
Amygdala	Natural killer cells
Substantia nigra	*control for migration and cytokine release
Basal ganglia	<i>(this space intentionally left blank)</i>
Cerebellum	<i>(this space intentionally left blank)</i>
Hypothalamus	<i>(this space intentionally left blank)</i>
Mesolimbic dopamine pathways	<i>(this space intentionally left blank)</i>
Periaqueductal gray	<i>(this space intentionally left blank)</i>

Figure 12: Cannabinoid Receptors and Localization

Effects of CB1 Receptor Agonists

- Central Effects
 - Impairment of short-term memory and simple learning tasks
 - Impairment of motor coordination
 - Altered sensory and time perception
 - Lethargy, sedation and slowed reaction time
 - Catalepsy
 - Analgesia
 - Antiemetic effect
 - Increased appetite
- Peripheral Effects
 - Tachycardia
 - Vasodilation
 - Decrease in intraocular pressure
 - Bronchodilation

Tetrahydrocannabinol (THC)

- Activates both CB1 and CB2 receptors
- Most widely used psychoactive agent
- Exerts euphoric effects, altered thinking patterns, altered memory, analgesia, appetite stimulation
- Tolerance!

Cannabidiol (CBD)

- Low binding affinity to CB1 and CB2 receptors
- Does not elicit any psychoactive effects

- Non-psychotropic antioxidant and neuroprotectant
 - Decreases the psychotropic activity of THC
- Thought to be beneficial in alleviating pain, inflammation, anxiety, psychosis, muscle spasms, and seizures

Potential Physiologic Responses to Cannabinoids²⁷

- Improves sleep
- Anti-seizure effects and neuroprotection
- Reduces anxiety and psychotic symptoms/PTSD
- Prevents nausea and stimulates appetite
- Reduces intraocular pressure
- Bronchodilator
- Relaxes muscles and reduces muscle spasms
- Relieves pain (especially neuropathic)
- Anti-inflammatory, anti-proliferative, anti-viral

²⁷ <https://www.cancer.gov/about-cancer/treatment/cam/patient/cannabis-pdq>

Pharmacokinetics and Pharmacodynamics

- IV and inhaled forms have fastest onset of action and highest bioavailability
- Vaporization bypasses the negative effects associated with smoking
- Dosing and titration is highly formulation- and patient-specific
- Potential drug interactions
 - THC: substrate of CYP2C9, CYP3A4
 - CBD: substrate of CYP2C19, substrate and inhibitor of CYP3A4
 - Additive effects with ethanol, barbiturates, benzodiazepines, antihistamines, opioids, anticholinergics and sympathomimetics

Cannabis Use In Patients With Sickle Cell Disease: 1²⁸

- Retrospective chart review of 72 adults with sickle cell disease (SCD) at the Jefferson University Hospitals Sickle Cell Program
 - Received 270 urine drug tests (UDT) between 1994-2009
- Objectives
 - Report demographics and clinical features of patients with SCD with a positive UDT for cannabis
 - Compare frequency of vaso-occlusive crises (VOCs) requiring emergency department (ED) and hospital admissions in patients with a positive UDT for cannabis versus those with a negative UDT
- Statistical analysis
 - Paired t-test, chi-square, Fisher's exact tests

Cannabis Use in Patients With Sickle Cell Disease: 2²⁹

- Key Finding
 - Increased frequency of vaso-occlusive crises requiring hospitalization in patients with a positive UDT for cannabis versus those with a negative UDT
- Limitations
 - Retrospective study
 - Small sample size
- Recommendations
 - Cannabis is not recommended for patients with sickle cell disease
 - Additional prospective studies are needed

²⁹ Cannabis and Cannabinoid Research 2017;2.1:197-201.

Behavioral Health/Psychology

CBT: Cognitive Techniques

- Help patient challenge their cognitive distortions
 - Anxious brain vs. rational brain
 - Rational brain
 - What is the evidence for and against the thought?
 - What is the likelihood that your concern will happen?
 - Perspective taking
 - Will it matter in a year?
 - How would you think about this if it were your friend?
- Use category of cognitive distortion to help with thought challenging
 - e.g., if the thought is “all-or-nothing,” introduce doubt to make it a “maybe” thought

CBT: Behavioral Techniques

- Evidence-based coping strategies that can decrease pain / stress experience
- Choose two or more coping strategies – practice daily and use as needed:
 - Diaphragmatic breathing
 - Progressive muscle relaxation
 - Mindfulness
 - Meditation

CBT: Behavioral Techniques – Diaphragmatic Breathing (DB)

- AKA deep breathing or belly breathing
- Basics
 1. Lie down (or sit comfortably) with knees bent and shoulders, head, and neck relaxed.
 2. Place one hand on your upper chest and the other hand just below your rib cage. This will allow you to feel your diaphragm move as you breathe.
 3. Breathe in slowly through your nose so that your stomach moves out against your hand. The hand on your chest should remain as still as possible.
 4. Exhale through pursed lips by tightening your stomach muscles and letting them fall inward as you exhale. The hand on your chest should remain as still as possible.
 5. Practice 5 minutes at a time, starting with 1-2 practice sessions per day.

CBT: Behavioral Techniques – Progressive Muscle Relaxation (PMR)

- **Basics**
 - First, you systematically tense particular muscle groups in your body, such as your neck and shoulders.
 - Second, you release the tension and notice how your muscles feel when you relax them.
 - Tense for 5 seconds, and then release for 5 seconds and notice the difference between the tension and relaxation.
 - Head-to-toe or toe-to-head, it does not matter as long as you are tensing and releasing in a stepwise manner across your body's muscle groups.
 - It is helpful to follow a stepwise script (paper) or a voice recording (mobile health app).

Role of Social Support (Family and Friends)

- Pain reducing behaviors (DOs):
 - Distraction
 - Engagement
 - Coping skills
 - Humor
- Pain promoting behaviors (DON'Ts):
 - Empathy (by itself)
 - Apologizing
 - Resting (by itself)
- Family and friends should:
 - Minimize their reactions to patient's pain
 - Praise patient for self-management of pain
 - Praise patient for engaging in normal activities, despite pain
 - Eliminate pain status checks, such as "How are you feeling?"

Transition from Pediatric to Adult Care

- Transition is a process, not a single discussion
 - Current recommendation is to start the conversation at age 12 years
- Providers can:
 1. Help patient and family to think ahead, starting early
 2. Discuss gradual transfer of control of health and disease management from parent to adolescent
 3. Encourage patient's development of self-management motivation and skills
 4. Encourage patient to engage in self-advocacy
 5. Discuss challenges of moving from a pediatric to an adult style of care
 6. Refer patient to adult providers who understand the patient's disease
 7. Transfer needed information to the adult provider
 8. Follow-up to ensure that transfer really occurred
- www.gottransition.org
 - Aligned with American Academy of Pediatrics, American Academy of Family Physicians, American College of Physicians

Physical Therapy

What is the role of the physical therapist?

Treat patients with multisystem involvement resulting from SCD

- Integumentary - wound care
- Cardiovascular/Cardiopulmonary - functional mobility & strengthening
- Musculoskeletal - mobility
- Neuromuscular Systems - posture, breathing and relaxation

General Exercise Guidelines³⁰

- Start exercising gradually
- Perform mild-moderate endurance exercise, avoid intense exercise and stop exercising at the first signs of fatigue
- Rest at least every 20 minutes
- Drink water before, during, and after exercising
- Avoid cold or heat stress
- Avoid contact sports

³⁰ Connes et al. Exercise Limitation, Exercise Testing, and Exercise Recommendations in Sickle Cell Anemia.

Examples of exercises that may be prescribed³¹

1. General endurance and light resistance exercises
2. Breathing
 - Diaphragmatic breathing + pursed lip
 - Lateral costal breathing
 - Stacked breathing
 - Incentive spirometry
3. Postural Exercises
 - Scapular Squeeze
 - Resisted scapular squeeze
 - Resisted scapular squeeze + breathing exercise

Chronic Pain

- Physical therapists, as part of an interdisciplinary team, can help you take an active role in your care
- Not one approach will always work - may range from exercise to complementary therapies
- Your team can help you learn coping skills and increase your level of function

³¹ Note: Always consult with your local physical therapist or physician before performing any exercises.

Living Well with Sickle Cell Disease

Because many health care providers are not familiar with Sickle Cell Disease, it is critical that patients take an active role in managing their own care. To make informed decisions, patients need to understand the disease and treatment options, and then make the best possible choices for their own care.

The tools provided in this [toolkit](#) will help patients to monitor their health care by keeping track of important information about their pain crisis patterns such as triggers, helpful nonpharmacological approaches, and effective medications.

The [toolkit](#) also helps patients communicate with the many health providers and services involved in their care.

Acupuncture

Learning Objectives

- Describe the historical and regional origins of acupuncture
- Explain how an acupuncturist would assess and characterize sickle cell disease
- Be familiar with tongue inspection and pulse palpation findings
- Discuss the concept of “blood stasis” and how it relates to Sharee’s presentation
- Discuss approaches to acupuncture treatment planning
- Describe the current evidence base relating to acupuncture and sickle cell disease
- Describe the specific risks and adverse events associated with acupuncture

Study Questions

1. Why is SCD not within the traditional scope of Chinese medicine?
2. List 3 elements of an acupuncture assessment.
3. How good is the evidence that acupuncture can help with SCD?
4. What are the common and rare adverse events associated with acupuncture?
5. Using an evidence-based medicine perspective—evaluating best evidence, clinical experience and patient values and preferences—would you recommend an acupuncture referral for Sharee?

Where is Acupuncture in Use?

- Acupuncture is a clinical modality that is frequently offered to pain patients
- Acupuncture is included in Traditional Chinese Medicine (TCM) and Korean Traditional Oriental Medicine (KTOM). It is an integral part of health care not only in China and Korea, but in Japan, Vietnam and other regions of Asia.
- Since the 1970s, acupuncture has been a licensed profession in the United States. Physicians and other professionals may also practice acupuncture.

What is Acupuncture?

- Acupuncture treats pain through the insertion of specialized needles into regions of the body determined by traditional theory, bioscience-based anatomy and physiology, and clinical assessment
- Needles range from .4 to .12 mm in diameter and from 15mm to 150 mm in length
- Needles are typically left in place for 20 minutes or up to 45 minutes, depending on the treatment plan. They are often manipulated to create stimulation.
- Needle insertion and stimulation elicits both local and central responses and has been demonstrated to reduce pain

Needle Insertion 1

A man who looks to be in his twenties lies prone on an examining table in a medical exam room. His entire right side faces the viewer. The table is

covered with a soft brown blanket. The patient's head is cradled by a pillow with a green pillow case. A cylindrical pillow under the brown blanket props his knees up to a one hundred sixty-degree angle instead of lying flat at one hundred eighty degrees. He wears a white undershirt and loose soft gray shorts that end at mid-thigh.

Behind the exam table is an articulated light in the left corner. A Chinese calligraphy painting hangs on the wall in the middle of the shot. A metal rolling cart with two shelves sits in the right corner. Various needles contained in their wrappers are in boxes on the bottom shelf. On the top shelf is a red sharps disposal container, a white paper towel laid out with various needles in their paper and plastic sterilized packets, a glass jar of cotton balls, two round metal canisters, a squeeze bottle of alcohol, and a glass jar of antiseptic wipes.

Dr. Ergil stands behind the patient, dressed in black slacks, a blue button up shirt and a red bow tie. He makes his way over to the metal cart and plucks a cotton ball from its glass jar before squirting some alcohol on it. He takes the cotton ball over to the patient and wipes the patient's forehead with the alcohol-soaked cotton ball. Then he does the same with the patient's right anterior forearm, just below the crook of the elbow.

Once Dr. Ergil disposes of the cotton ball, he picks up an acupuncture needle and walks back over to the patient's head. The shot switches to a close up of the patient's forehead, right between his eyebrows. Dr. Ergil inserts the white tipped acupuncture needle firmly between the patient's eyebrows. It appears as though the slender needle is the width of five

human hairs. Dr. Ergil maintains the pressure on the needle until it embeds into the patient's skin to a depth of a quarter inch or so.

Next, Dr. Ergil comes around to the patient's right side. With his back facing the viewer and reading glasses on, Dr. Ergil places the same size needle into the patient's forearm in the area he previously disinfected. Using a rolling motion while he pinches the white tipped needle between his thumb and forefinger, Dr. Ergil sinks the tip into the patient's skin to a depth of just more than a quarter of an inch.

Next, Dr. Ergil moves to the patient's right leg. Standing on the patient's left side still wearing his reading glasses, Dr. Ergil palpates the right shin, five inches below the knee, just to the right of the shin bone itself. Using the same rolling motion with his thumb and forefinger, a close-up shot of the white tipped acupuncture needle shows it sinking just over a quarter of an inch into the patient's skin.

Dr. Ergil pats the man's knee to make sure he's all right. The patient closes his eyes and smiles in agreement to let Dr. Ergil know he can continue with the needle insertion.

The video skips to Dr. Ergil explaining he inserted a total of five acupuncture needles (only three insertions are shown in the video).

"So, I've just inserted five acupuncture needles," Dr. Ergil says. He takes off his reading glasses as he stands behind the exam table, on the patient's left. He places the glasses in his shirt's front pocket, where they rest next to a pen.

“This is a typical harmonizing supplemental treatment. I’ve inserted the needles that are known as the Inner Four Gates. These are large intestine ten, just distal to the elbow” and Dr. Ergil gestures to the needle inserted into the patient’s right forearm.

“And stomach thirty-six just distal to the knee,” continues Dr. Ergil, motioning to the patient’s right shin.

“And then, a spirit-calming point, which is known as ‘yin-tang,’” says Dr. Ergil as he makes his way back to patient’s head and gestures at the needle inserted between the brows.

“Now, typically this type of treatment would be retained for about fifteen to twenty minutes. It’s supportive, harmonizing, relaxing, comparatively non-specific. Some of these points might be used with a patient whose case you’ve been following, but they can be used in many different clinical contexts.”

Needle Insertion 2

Dr. Ergil stands behind an examining table with his back to the wall of a medical exam room. A Chinese calligraphy painting hangs on the wall in the middle of the shot. A metal rolling cart with two shelves sits in the right corner. Various needles contained in their wrappers are in boxes on the bottom shelf. On the top shelf is a red sharps disposal container, a white paper towel laid out with various needles in their paper and plastic sterilized packets, a glass jar of cotton balls, two round metal canisters, a squeeze bottle of alcohol, and a glass jar of antiseptic wipes.

Dr. Ergil is dressed in black slacks, a blue button up shirt and a red bow tie. In front of him lies a woman, face down on the exam table. Her face is cradled by a cushioned cut out and her hips are raised at an angle with a cylindrical pillow underneath her. She wears a blue top with Velcro fastenings in the back and a white sheet covers her up to her shoulder bones.

“Hello, I’m going to demonstrate needling six frequently acupuncture points. These points are used to treat neck pain, shoulder pain, upper back, mid-thoracic and lower back pain very frequently.”

“They’re needled at different depths and angles, so you’ll see those techniques a little bit. These points, I’ll name them after they’re inserted.”

Dr. Ergil starts unfastening the Velcro on the back of the blue top of the patient.

“So, just to reassure you, hand-washing has occurred. It typically has occurring off-camera because of our set-up today.” Once Dr. Ergil finishes unfastening the patient’s Velcro fastenings on the back of her blue top, he tugs the white sheet down to expose her back to just below the beginning of the buttocks.

Turning to the metal rolling cart, Dr. Ergil picks a cotton ball out of its glass jar and soaks it in alcohol. He applies the alcohol-soaked cotton ball to the patient’s right shoulder, just above her shoulder blade, then does the same with her left shoulder before disposing of the cotton ball.

With a new alcohol-laden cotton ball, Dr. Ergil swipes the length of the inner portion of either shoulder blade on the patient's back. A close-up shot shows Dr. Ergil palpating the patient's back on the upper outside of the shoulder blade. (This area was not shown to be disinfected in the video to save time. However, the disinfecting did take place.) Using a rolling motion with his forefinger and thumb, he inserts a white-tipped acupuncture needle to a depth of three eighths of an inch.

Turning back to the metal rolling cart, Dr. Ergil picks up a new acupuncture needle. A close-up shot shows needle insertion at the point just above the inner portion of the shoulder blade, to the left of the neck. This time he inserts the needle with a gentle pulsing movement, first pushing it in, then pulling it out slightly before completing the placement. This white-tipped needle shows itself inserted to a depth that stops just below the white-tipped opposite end, much deeper than the others so far.

Dr. Ergil picks up another acupuncture needle from the metal cart behind the patient. A medium shot shows the breadth of the patient's back, with her upper back towards the bottom of the frame. One gray-tipped acupuncture needle already sticks out of the patient's back on the inside of her right shoulder blade, two inches from her spine. Dr. Ergil palpates the area exactly opposite of the first needle with his left forefinger while he holds the acupuncture needle between the first three fingers and thumb of his right hand. Rolling the needle between his fingers, he inserts it to half its length.

The same shot shows both needles placed just inside and below either shoulder blade. Dr. Ergil placed another needle above the patient's right

iliac crest, two inches away from her spine between the last scene and this new one. He now palpates the area opposite the already-placed needle to insert a mirroring one. This time, he palpates with his left middle finger before inserting the needle with his right hand. Using a combination of rolling the needle between his fingers and a gentle pulsing action, the needle comes to rest at a depth of half an inch.

Needle Extraction

Dr. Ergil stands behind an examining table with his back to the wall of a medical exam room. A Chinese calligraphy painting hangs on the wall in the middle of the shot. A metal rolling cart with two shelves sits in the right corner. Various needles contained in their wrappers are in boxes on the bottom shelf. On the top shelf is a red sharps disposal container, a white paper towel laid out with various needles in their paper and plastic sterilized packets, a glass jar of cotton balls, two round metal canisters, a squeeze bottle of alcohol, and a glass jar of antiseptic wipes.

Dr. Ergil is dressed in black slacks, a blue button up shirt and a red bow tie. In front of him lies a woman, face down on the exam table. Her face is cradled by a cushioned cut out and her hips are raised at an angle with a cylindrical pillow underneath her. She wears a blue top unfastened to show the expanse of her back. A white sheet covers her up to just below her iliac crest.

Dr. Ergil turns to the metal cart and soaks a cotton ball from the glass jar in some alcohol. Turning back to the patient, he removes the acupuncture needle just above the iliac crest on the patient's left side and places the

alcohol-soaked cotton ball over the former insertion site. He gives the site a swipe with the cotton ball before turning to dispose of the acupuncture needle in the red sharps container on the metal cart.

Once facing the patient again, Dr. Ergil follows the same procedure with the acupuncture needle inserted above the patient's iliac crest on her right side. He removes the other four needles at the patient's bottom inside shoulder blades and at the upper inside of the shoulder blades. Each extraction followed by the quick swipe of the alcohol-soaked cotton ball takes three seconds or so.

Use of Acupuncture in Sickle Cell Disease

Traditional Chinese Medicine has rarely been used to manage sickle cell disease (SCD)³², because SCD occurs among Africans and is virtually unknown in Asian populations.

However, with the globalization of acupuncture, acupuncturists outside of China have sometimes used acupuncture to treat SCD patients successfully during crisis episodes. An acupuncturist in Lagos, Nigeria wrote that when he treated a case of sickle-cell crisis:

"...the result was so effective, dramatic and encouraging that four other cases of genotype SS/SC were also treated³³."

³² <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1770296/>

³³ <https://www.ncbi.nlm.nih.gov/pubmed/?term=sodipo+1993+sickle+cell>

Traditional Chinese Medicine Assessment

- Diagnostic procedures used by acupuncturists include taking a patient history and conducting a physical examination.
- The physical examination includes distinctively traditional elements such as:
 - pulse palpation
 - abdominal palpation
 - channel palpation
 - inspection of tongue and skin
- This assessment process is traditionally known as the Four Examinations.

The Four Examinations

In Chinese medicine, the "4 Examinations" move from the least to the most intimate.

- Inspection
 - Visual examination of any aspect of the body including the tongue, excreta and discharge.
- Listening and smelling
 - Auditory and olfactory assessment of the character of sounds (vocalization, coughing etc...) and smells produced by the patient or their excreta and discharge.
- History taking
 - This includes history of chief complaint, review of systems and other aspects of a conventional history.
- Palpation
 - Palpation of the body and arterial pulses.

Taking the Patient's History

- When taking the history, a clinician is concerned with understanding the manifestation of pain, its location among body regions, and the triggers of vaso-occlusive crises (VOC) and other clinical complications.
- Sharee's subjective impression of "feeling cold" and her report that cold can trigger a crisis are diagnostically meaningful in understanding the condition, implicating both blood stasis and qi vacuity.

Significance of Tongue Inspection in Chinese Medicine

- The tongue is highly vascular and the status of its perfusion is readily apparent. Hence it can be used to assess the status of a patient's circulatory system as a whole.
- The tongue tissue (body) and the overgrowth around the papilla (fur) are inspected. Erosion, scalloping of the tongue margins, sores, glossitis, and abnormal movement are useful signs in the tongue examination.
- The tongue is in close communication with the gastro-intestinal tract, so it can readily display GI changes and the status of the GI microbiome. Changes in the tongue fur indicate bacterial or yeast overgrowth.

Why the tongue is examined

Traditionally the tongue is:

- The "sprout of the heart"
 - The heart, which governs blood, opens into the tongue
- External sign of the spleen (understood as an organ of digestion and blood production).
- "Root of the after heaven"
 - The "after heaven" refer to physiological processes that commence after the first breath is taken and are the source of the generation of qi and blood
- Changes to the tongue body reflect the state of qi and blood of the viscera and bowels.

Inspection of the Tongue Body

- Color and sheen
 - Pale and white suggest “cold” or insufficiency of blood
 - Red and crimson suggest “heat” or inflammatory processes
 - Congested purple shades suggest blood stasis (poor circulation)
- Form and bearing
 - The shape and movement of the tongue can offer diagnostic insights
- Moisture
 - Abnormal dryness or moistness can signal pathological processes

Normal Tongue

A normal tongue has a pale red (or pink) body with thin white fur (i.e., the tongue body to be readily seen through the fur)

- The tongue body should be
 - Pale red, bright and moist
 - Neither fat nor thin
 - Supple, soft and flexible
- The fur should be
 - Thin, white and evenly distributed
 - Neither too wet nor too dry

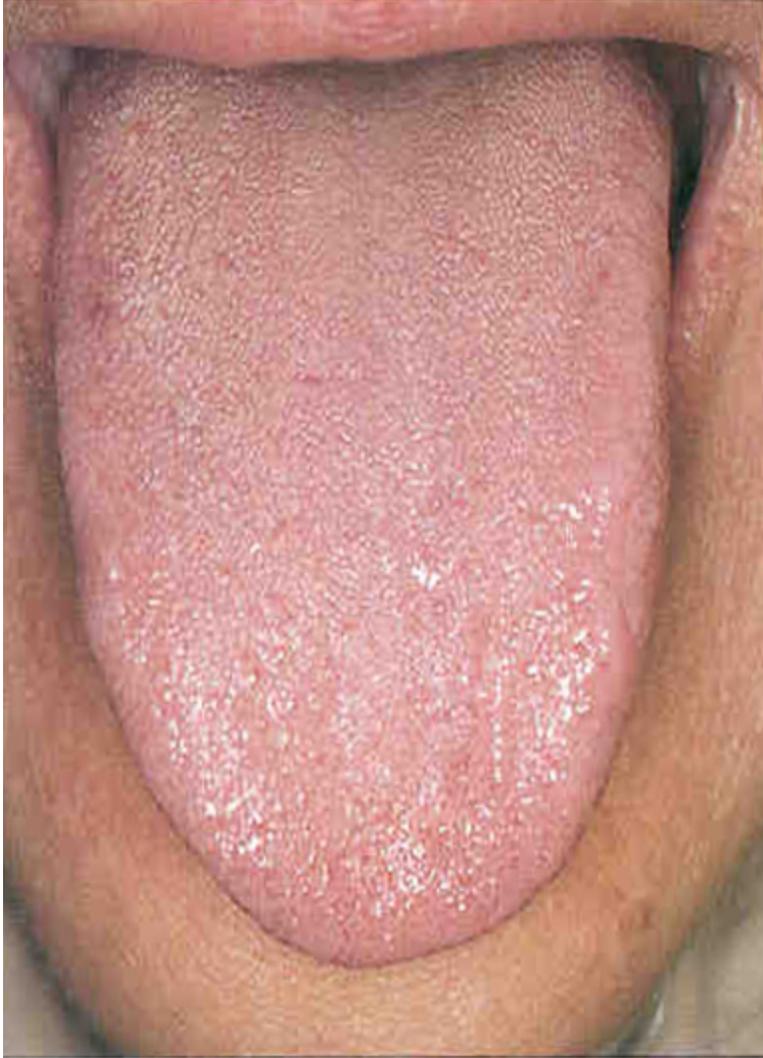


Figure 13: Normal tongue. Kirschbaum, Barbara. 2010. Atlas of Chinese Tongue Diagnosis 2nd ed. used with kind permission of Eastland Press, Seattle.

Pale White or Red Tongue

- Pale and white signify repletion cold
 - Body is pale white, the fur is white, slippery and thick
 - Yang vacuity that causes internal collection of cold damp is indicated by
 - Body is pale white, the tongue body is enlarged and tender, damp and moist with much fluid, and on the sides of the tongue there are teeth impressions.



Figure 14: Pale white tongue. Kirschbaum, Barbara. 2010. Atlas of Chinese Tongue Diagnosis 2nd ed. used with kind permission of Eastland Press, Seattle.

- Red tongue
 - Tongue color is deeper than normal
 - Red governs heat

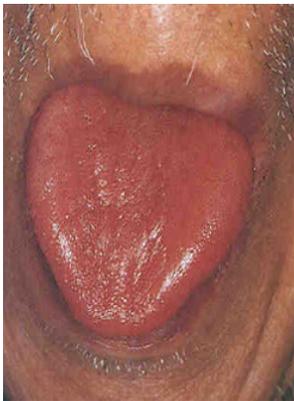


Figure 15: Red tongue. Kirschbaum, Barbara. 2010. Atlas of Chinese Tongue Diagnosis 2nd ed. used with kind permission of Eastland Press, Seattle.

Tongue Fur

- Tongue "fur" is formed when papilla on the surface of the tongue trap debris such as bacteria and dead cells.
- Normal fur is so thin that the tongue body can be clearly seen.
- What aspects of the tongue fur are inspected?
 - Development
 - Color
 - Thickness
 - Moisture
- Traditionally, "normal" tongue fur is created from the rising and evaporation of stomach qi. It is a sign of healthy digestion and a functional microbiome.
- When disease develops, the fur thickens. This suggests a developing internal pathological process.



Figure 16: Tongue fur. Kirschbaum, Barbara. 2010. Atlas of Chinese Tongue Diagnosis 2nd ed. used with kind permission of Eastland Press, Seattle.

Inspection of the Tongue Form

Prickles are signs of heat and stasis



Figure 17: Tongue prickles. Kirschbaum, Barbara. 2010. Atlas of Chinese Tongue Diagnosis 2nd ed. used with kind permission of Eastland Press, Seattle.

Teeth Impressions/Scallops are signs of qi vacuity and spleen vacuity

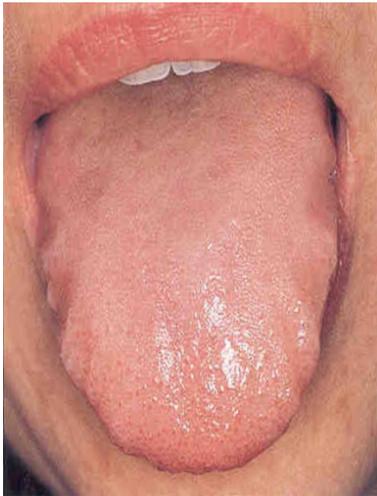


Figure 18: Tongue scallops. Kirschbaum, Barbara. 2010. Atlas of Chinese Tongue Diagnosis 2nd ed. used with kind permission of Eastland Press, Seattle.

Pulse Diagnosis

Part of a palpation exam

- Used in conjunction with the findings of the 4 examinations (especially the history).
- Must be interpreted along with other information, such as how and when the condition arose, the nature of the patient's complaint, dietary irregularities, excesses of sleeping and waking.

Procedure

- One palpates the radial artery at the level of the styloid process of the radius, using the three middle fingers.
- Once the rate is assessed, varying degrees of pressure are used to determine the depth, force, rhythm, and quality of the pulse.

Traditional Perspectives on Pulse Diagnosis

- The heart and the pulse have a close relationship
 - Heart governs blood and vessels
 - Blood depends upon heart qi to move it around the body
- The pulse image can reflect physiological and pathological changes in the body.
- Heart qi is reflected in the rhythm of the pulse.

What Pulse Diagnosis Can Tell Us

- From the information provided by the pulse, various insights into the disease process can be obtained.
- Typically 28 standard pulse terms are used to describe commonly encountered pulse forms or 'images'. These terms characterize the pulse by
 - Level
 - Rate
- Force
 - Rhythm
 - Quality

Term #28. StringlikePulse / 弦脉 xiánmài

- Clinically this is the most commonly seen pulse. Image/Description:
 - Long and straight and stiff under the fingers
 - Like touching the strings of a qin, think straight and long with energy and force
- Cause: Liver qi is not flowing smoothly/correctly, this can cause hyper tonicity of the channels and vessels, contraction of qi and blood or congestion of qi and blood.

Findings of Sharee's physical examination

- Pulse palpation and tongue inspection provide useful information relevant to Sharee's case:
 - Pulse palpation shows a "string-like" pulse, which suggests that liver qi is not flowing smoothly/correctly
 - Tongue inspection shows thick white coating and heat speckles
 - Teeth Impressions/Scallops are signs of qi vacuity and spleen vacuity



Figure 19: Sharee's tongue findings

Assessment of Sharee's Condition

- In traditional Chinese medicine, pattern diagnoses are identified by findings from the history and examination.
- Clinically, Sharee presents with pulse and tongue signs that are associated with the following specific diagnostic patterns:
- Qi Stagnation & Blood Stasis (impeded blood flow, vaso-occlusive crisis, acute chest syndrome)
- Qi and Blood Vacuity (fatigue and anemia)

- Dampness encumbering spleen and stomach (organ impacts of SCD, digestive disturbance)

Blood Stasis – Clinical Concept

- Blood Stasis was identified as a clinical entity in 200 BC, and over the centuries both traditional and contemporary scientific explorations of this concept have led to many clinical approaches to conditions characterized by poor perfusion or impediments to circulation.
- From a TCM perspective, blood stasis can both result from and contribute to pathological processes. In Sharee's case, the signs of interior dampness as discussed in the video originate in blood stasis.
- Blood stasis is thought to be relevant to the treatment of many gynecological conditions, chronic hepatitis, scleroderma, multiple arthritis, Raynaud's disease, and others.

Blood Stasis and Sickle Cell Disease

- The clinical presentation of SCD, because of its complexity and variable presentation, involves several diagnostic patterns. The characteristic pathophysiology of SCD, which is inhibited flow of blood, suggests the TCM diagnosis of blood stasis. The wide range of other systemic effects suggest other diagnoses as well.
- Blood stasis is general impairment of the smooth flow of blood, causing local stagnation of blood in the vessels or organs. Static blood and its resulting pathologies are characterized by fixed stabbing pain.
- In addition to her pain crises, Sharee has developed avascular necrosis or death of bone tissue due to lack of blood supply.

- She also has had symptoms of acute chest syndrome, which is a vaso-occlusive crisis of the pulmonary vasculature

Summary of Sharee's Assessment

Specific TCM patterns are suggested by specific findings:

- Qi Stagnation & Blood Stasis
 - Stress can produce onset
 - Cold exacerbates or triggers
 - Pain quality is similar to being cut and has a throbbing quality
- Qi & Blood Vacuity
 - Hemolytic anemia can reduce RBC count
 - Systemic impacts of SCD produce fatigue
 - Chilliness can be a sign of qi vacuity

Choosing Points for Acupuncture Stimulation

- Effective acupuncture requires identification of precise acupuncture points for stimulation.
- The body is visualized to have a network of channels and vessels that connect a large number of acupuncture points
- The specific location of the patient's pain directs the choice of points for acupuncture stimulation.
- For example, the lung channel shown in the next slide connects a series of 9 acupuncture points that are potential targets for treatment of chest pain in a vaso-occlusive crisis.

The Lung Channel

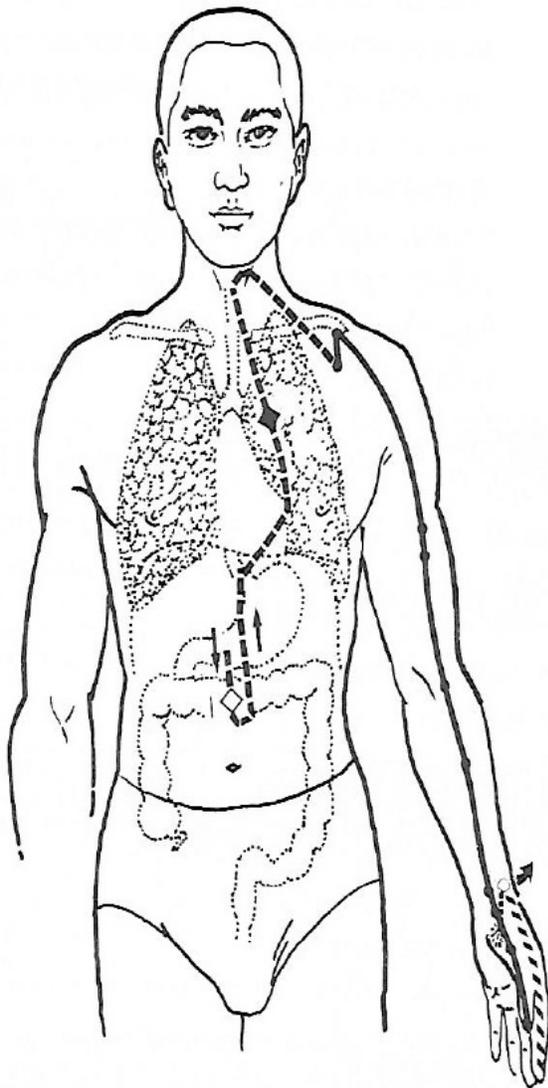


Figure 20: Lung channel. Figure from Ellis, Wiseman, and Boss. Fundamentals of Chinese Acupuncture.1991. Used with the kind permission of Paradigm Press.

The figure displays the primary channel of the lung, as well as its connections to related channels and organs. The solid lines display the pathway on the shoulder and arm where points are distributed. The broken lines show how the channel is connected to internal organs.

In Sharee's case, channel points for acupuncture might be selected according to the regionalization of joint pain and, in cases of a vaso-occlusive crisis, of the pulmonary vasculature.

Other indicators of acupuncture points to target

- Tender Points
 - Acupuncture points that are reactive on palpation may be particularly good candidates for treatment.
- Distal Points
 - According to traditional theory, acupuncture stimulus is often applied locally and distally.
 - For chest pain, points on the shoulder (LU-1) and the wrist (LU-9) are often targeted.

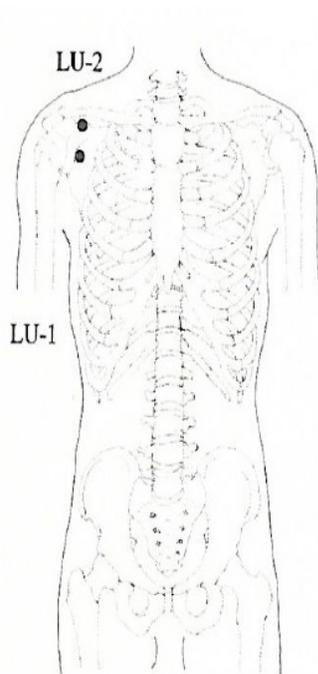


Figure 21: Lung 1/Central Treasury. Located on tissue that is innervated by the intermediate supraclavicular nerve, branches of the anterior thoracic nerve, and the lateral cutaneous branch of the 1st intercostal nerve.

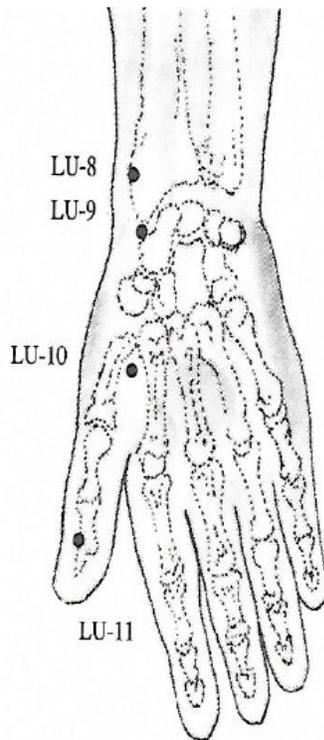


Figure 22: Lung 9/Great Abyss. Often treated for pain in the chest. Clinically the combination of Lung 1 and Lung 9 could be applied for chest pain involving the lungs.

Planning Sharee's Treatment with Acupuncture

- Acupuncture point selection is an important part of treatment planning
- In this case, points would be selected based on:
 - Diagnostic patterns
 - Regionalization of pain presentation (especially in vaso-occlusive crises)
 - According to channel distribution
 - Based on the tenderness of established acupuncture points
- Treatment would be revised, based on the patient's response

Evidence for the Effectiveness of Acupuncture in Sickle Cell Pain

- The quality of the evidence base for the use of acupuncture in a range of painful conditions is steadily improving (Vickers et al. 2012, 2014, 2018 <https://www.ncbi.nlm.nih.gov/pubmed/29198932>)
- Evidence Map of Acupuncture (Hempel et al. 2014 <https://www.hsrd.research.va.gov/publications/esp/acupuncture.pdf>)
- The evidence base for the use of acupuncture in sickle cell disease is limited.
- The most robust and suggestive evidence is a retrospective study conducted at the National Institutes of Health from 2005 through 2011 examined outcomes 24 patients who received acupuncture (Lu et al. 2014 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4159140/>)
- Pain outcomes for patients who received inpatient acupuncture for acute vaso-occlusive crises showed an average 2.1 point reduction on the 10 point numeric pain scale.
- The authors conclude that the findings suggest the possible use of acupuncture as an adjunctive method for managing pain in SCD.

Acupuncture Adverse Events

- Minor risks
 - Pain on needle insertion (commonly experienced)
 - Bleeding, and bruising (commonly experienced)
 - Transient nerve damage (relatively rare)
- Infection is typically rare when appropriate aseptic technique is used

- Sterile single use disposable needles, appropriate skin cleansing and handwashing substantially reduce risk.
- Organ puncture and damage to tissue
 - Pneumothorax: comparatively rare, but possibly underreported
 - Damage to heart, liver, kidney, spinal cord, spinal nerves, brain stem are rare.

Consent

Dr. Ergil stands behind an exam table in a medical exam room. A Chinese calligraphy painting hangs on the wall behind him on the left. A metal rolling cart with two shelves sits in the right of the shot. Various needles contained in their wrappers are in boxes on the bottom shelf. On the top shelf is a red sharps disposal container, a white paper towel laid out with various needles in their paper and plastic sterilized packets, a glass jar of cotton balls, two round metal canisters, a squeeze bottle of alcohol, and a glass jar of antiseptic wipes.

Dr. Ergil wears black slacks, a blue button-up shirt, and a red bow tie. A pen and his reading glasses peek out of the front pocket of the shirt. He addresses the camera directly.

“I’m going to present the consent process that we do typically orally with all our patients. This is based on providing information about minor and major risks of acupuncture. So, I’m going to speak to you as if you were a patient for the most part, so it’s got a degree of informality, but I try to cover everything that we really need to cover.”

“So, acupuncture has what we consider four commonly encountered minor adverse events. And when we say ‘minor,’ we don’t think they’re very significant. They can cause discomfort, but we don’t think they put the patient at significant risk. When we say, ‘commonly encountered,’ we mean almost every patient will have one of these events or a few of them at some time.”

“These are pain on needle insertion, because we try to minimize pain and discomfort with needle insertion, but there still can be. The skin is nerve-rich, so there can be a sharp feeling or some discomfort when the needle enters the body. If the discomfort persists or there’s sharpness as we advance the needle, we don’t aim for that, and we’ll usually be retracting the needle promptly.”

“Then, there can be bleeding if we nick a small vessel, we can cause a little bleeding and usually if there’s some subcutaneous bleeding there can be attendant bruising. Neither of those is typically a major problem but if the bruise is trapped against bone or in a tight area, there can be discomfort from the bruising.”

“Then the fourth of these we call transient nerve damage. This involves needling a little too close to a nerve tract or pathway. It causes local numbness and tingling that’s typically quite unpleasant for the patient. It lasts two to three days. It’s usually relieved with a little heat, massage, and time. This is rare, but we do like to mention it to people because it can happen.”

“The most significant risk that we associate with acupuncture that’s pretty much possible at any treatment is infection. That’s because we break the skin with a sharp object. Now, what we do to control for infection is we’re very careful about hand-washing. We typically, although this isn’t mandated, but we do typically clean the skin site with alcohol before needling. The needles we use are pre-sterilized with ethylene-oxide gas. Once they’re used, they’re permanently disposed of.”

“So, in general, needles are never reused and they emerge sterile from their packaging. So, that combination of hand-washing, skin-cleansing, and sterile and permanently disposed of needles gives a very high level of infection control for most patients. Still infection’s always a risk because we break the skin. So, one has to mention it. It is, if clean and sterile is done correctly, the risk is very minor.”

“Finally, there are what we think of as clinical outliers. Unusual events, some of them are quite devastating, but they’re exceptionally rare. These are incidents such as puncture of the heart, kidney, liver, spinal cord, or

brain stem. And with the possible exception of the kidney, it's very difficult to do these unintentionally during a correctly performed clinical procedure. So, I mention them for completeness, but quite honestly, I don't worry about them very much and I don't think patients need to."

"The risk that is rare, but frequent enough and can happen accidentally, even to very skilled practitioners, is known as a pneumothorax. This can occur when we needle over the chest, shoulders, thoracic cavity, upper back, anywhere over the area of the lungs. If the needle is inappropriately angled or inserted too deeply, there is the possibility the lungs could be slightly torn and air can enter the pleural cavity and impeded breathing function. Which is as serious and unpleasant as it sounds."

"A minor event can simply manifest as a cough and a little shoulder pain. A serious event can result in the need for hospitalization, typically in an ICU for two to three days with intubation to maintain respiration."

"So, obviously, that's something that every clinician wants to avoid. It's very rare. We think of it occurring on the order of approximately three times per million treatments, roughly. However, its rarity doesn't really mitigate its severity, so if it does happen, it's a serious problem and we try to avoid that."

"Additional events that should be considered: while acupuncture is safe during pregnancy, there is some consideration about levels of stimulation, so being aware whether a patient is pregnant or desiring to become pregnant is typically important for us to know."

"We also like to advise patients, especially the first time they have acupuncture that sometimes there can be dizziness, or a slight, we call it a vaso-vagal response, basically an incident of light-headedness or fainting and when that occurs, we remove the acupuncture needles and allow the patient to rest and get comfortable."

"Sometimes patients feel exceptionally relaxed or even a little, almost blissed out after treatment. And while we don't think is an adverse event, sometimes it's really necessary for patients to take a few moments and

just relax and re-orient after treatment, possibly sitting down somewhere quietly while they do that.”

“This is a video event, so I can’t do what I do next with patients, but once I’ve explained the risks of acupuncture, we talk about ways in which acupuncture might benefit the patient. I make plenty of time and give plenty of opportunity for the patient to ask questions.”

“Thank you very much.”

Why is SCD not within the traditional scope of Chinese medicine?

Sickle cell disease rarely occurs in Asian populations.

Key elements of an acupuncture assessment

- Inspection (especially tongue)
- Listening and smelling
- History taking
- Palpation of the body (especially pulse)

These lead to determination of a pattern diagnosis

How good is the evidence that acupuncture can help with SCD?

There is some evidence, but it is limited because TCM is not commonly practiced in countries with African populations. May be effective as an adjunctive therapy for chronic, poorly controlled pain.

Should Sharee Get an Acupuncture Referral?

- Best Evidence: While the evidence for acupuncture specifically in SCD is limited, the evidence for acupuncture in managing some types of

pain is very good. The limited data available on use of acupuncture in SCD suggests benefits.

- **Clinical Experience:** Clinical experience is limited because few SCD patients have access to acupuncture.
- **Patient Values and Preferences:** Sharee would like to have fewer episodes of vaso-occlusive crises and have a non-pharmacological method for reducing the severity of these painful episodes. The fact that opioids may induce or exacerbate acute chest syndrome should also be considered.

Resources

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