

# An Unexpected Loss: Healing Through Rehabilitation and Virtual Reality

by

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## Part I – Heel Won't Heal

*Joe Dunham decides it is time to see the doctor for the wound on his left foot that is not healing and very uncomfortable. After finishing his last cigarette, the 59-year-old, overweight man limps from the parking garage to the emergency department. After spending about 15 minutes in the waiting room, the nurse calls his name and checks his vital signs. The vital signs show that Joe has a fever (temperature 100.8 degrees Fahrenheit) and high blood pressure (150/90 mmHg), but his heart rate (80 beats per minute) and oxygen levels (98% oxygen saturation) are normal. The nurse escorts Joe into the exam room where he waits for Dr. Banks. Dr. Banks reviews Joe's electronic medical records. He finds that Joe has a history of type II diabetes mellitus, hypertension, hyperlipidemia, and peripheral vascular disease. He enters the exam room where Joe is sitting.*

*Dr. Banks:* Hi Joe. Tell me what brought you here today.

*Joe:* Hi Doc. A few months ago I found a small pebble in my left shoe and at the same time noticed that I had a cut on my heel. The pebble might have been in my shoe for a few days—I didn't feel it at all. The cut doesn't seem to be getting any better and I'm concerned about it. I've also been feeling feverish lately.

*Dr. Banks:* (Nodding) I see, I will certainly examine the wound. The fever is concerning. Tell me about your health history.

*Joe:* I have diabetes and doctors in the past have told me that I have high blood pressure, high cholesterol, and peripheral vascular disease.

*Dr. Banks:* Do you smoke?

*Joe:* Yes, I am trying to quit, but I've not been successful.

*Dr. Banks:* Are you taking any medications?

*Joe:* Well...I used to be on a diabetes pill, but I ran out of them and didn't go back to the doctor for a refill. So, I'm not taking anything now.

*Dr. Banks:* OK, let's take a look at your wound.

*Doctor Banks carefully examines the wound on Joe's heel which appears deep and measures 3 cm × 2 cm on the skin surface. He notes that there is copious, foul-smelling, yellowish drainage from the wound. The foot is red, warm, and visibly swollen. He also notes that Joe lacks sensation on the foot.*

*Dr. Banks:* Joe, I'm concerned with the appearance of this wound. I would like to get some bloodwork, an X-ray, and a wound culture. I'm also going to ask our orthopedic surgery team to take a close look at your wound.

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*Questions*

1. Considering Joe's health history and physical exam results, the doctor orders a complete blood count (CBC) with differential and a hemoglobin A1c. Why would the doctor order these specific tests?
2. Why is the doctor ordering an X-ray and consulting with the orthopedic surgery team?
3. What is the physiological basis for developing a fever in response to infection?

## Part II – Bad News

*Joe's lab results come back. He has a hemoglobin A1c level of 9.6 and white blood cell (WBC) count of 22,000. The differential demonstrates 93% neutrophils. The orthopedic surgeon probes the heel bone through the wound, which means that it is possible for bacteria to have also entered the wound and caused an infection. X-ray results suggest that Joe has osteomyelitis. A gram stain reveals clusters of gram-positive cocci, suggesting the presence of Staphylococcus aureus bacteria.*

*Dr. Banks:* Joe, it looks as if your heel bone has a bad infection. Your body is mounting an inflammatory response to try to fight the infection, but in this case, it's just not enough. You also need strong medication. I'd like to admit you to the hospital for intravenous (IV) antibiotics and close monitoring.

*Joe:* Oh, wow. I was not expecting this. OK, Dr. Banks, whatever is best for my health.

*Joe is admitted to the hospital. He remains in the hospital for two weeks and receives a series of broad-spectrum IV antibiotics, but the wound only worsens and progresses up his leg. While Doctor Banks often provides Joe encouragement, he must also break the bad news.*

*Dr. Banks:* Joe, I'm so sorry to tell you this, but your heel bone infection doesn't seem to be improving; in fact, it's getting worse in spite of multiple treatments. I believe that if we don't take drastic measures, you will quickly become more ill. To prevent any further complications, I regret to say that it is best to amputate part of your left leg from the middle of the thigh down.

*Joe:* (*Angrily*) What?! No! I can't lose my leg.

*Dr. Banks:* I understand this is very difficult. I'm sorry to have to discuss this with you. We have tried our strongest antibiotics, but the wound has only worsened. If we don't act soon, the bacteria from your wound will enter the bloodstream and cause a severe systemic infection called sepsis. That could make you even more ill and potentially kill you.

*Joe:* (*Holding his head in hands*) I can't believe this is happening. (*Pause*) Okay Doc, let's do it.

### Questions

1. What is the normal WBC count range, and what does Joe's level suggest? What about his neutrophil count and presence of *Staphylococcus aureus* bacteria?
2. What does Joe's hemoglobin A1c level suggest?
3. What are the cardinal signs of inflammation?
4. Break down the word osteomyelitis (*osteo-myel-itis*). What does each part of the word mean and how can each part be used to define the term?
5. What are Joe's risk factors for developing diabetes mellitus, type 2?
6. What is a diabetic neuropathy and how did it contribute to this case?

## Part III – Good News

*Two months after the surgery Joe is functioning independently in a wheelchair. He is now ready to follow up with a rehabilitation medicine doctor, Dr. Klein. His clinical vital signs reveal a normal temperature, blood pressure, heart rate and oxygen levels. He feels much better but is now having a lot of pain from the amputated side. He has been meeting with his primary care doctor to establish a regimen for taking medicine to control his blood pressure and diabetes. The amputation wound has healed, and the surgical staples have been removed by the orthopedic surgeon.*

*Dr. Klein:* Hi Joe, how have you been feeling?

*Joe:* Much better. I've been seeing a primary care doctor who has started me on medicine for blood pressure and diabetes. The main problem now is that I keep feeling so much pain in the area that feels like where my lower leg and foot used to be. It's really weird and frustrating.

*Dr. Klein:* What does it feel like? When does it happen?

*Joe:* It can vary. Sometimes it's sharp and at other times it feels like pins and needles—kind of like when you hit your funny bone. It seems to be there all the time but gets worse when I focus on it.

*Dr. Klein:* (Nodding) Sorry to hear that. I think I can help with that pain. On another note, how have you been doing getting around these days?

*Joe:* I've been mostly using my wheelchair to get around inside and outside of my house. I'm getting tired of the chair, though. When can I get a new leg? I'm ready to get walking again. I'm also anxious to start playing with my grandkids again and return to my job in the factory.

*Dr. Klein:* (Nodding) Great. Now that your wound is healed, I think you're ready to be fitted with a prosthetic leg. I'm going to ask a physical therapist to help me determine which type of prosthesis would be best for you.

*A physical therapist assesses Joe in the gym. Per the evaluation, Joe's strength, balance, and endurance are sufficient for him to receive a prosthesis. The physical therapist and Dr. Klein discuss which type of prosthesis would be most appropriate. Dr. Klein then informs Joe of their decision.*

*Dr. Klein:* (Writing) Joe, I'm writing you a prescription for a suction-sealing, above-knee prosthesis as well as a medicine that should help with your pain. After you receive the new leg, I also want you to undergo a full course of physical therapy to help you walk again with this new prosthesis.

*Joe:* Thanks so much, Doc. I'm really looking forward to being able to walk again.

### Questions

1. Even though Joe's lower leg and foot have been removed, he feels considerable pain in that area. What is this phenomenon called and why does it occur? How does this differ from pain in the remaining part of the limb?
2. Explain how Joe's prosthetic leg will remain attached to his body.
3. Using a reputable medical source, prescribe a medication to treat Joe's pain. Explain your reasoning.
4. Describe the role of a physical therapist in the rehabilitation of patients with limb loss. In addition to the physician and the physical therapist, what other health care team members might be involved in Joe's recovery?

## Part IV – Alternative Treatments

*Joe visits Doctor Klein after undergoing physical therapy and utilizing his new lower extremity prosthesis. He is making good progress in ambulation, but still feels considerable, persistent pain in the previously location of his amputated foot despite his treatment plan. During Joe's next appointment with Dr. Klein he asks for alternative treatments.*

*Dr. Klein:* This pain sounds really difficult.

*Joe:* Yes, I can't take it anymore, Doc. I need to try something else, but I don't want any more pills.

*Dr. Klein:* Well, there is a physician that I know who is using virtual reality to treat phantom pain.

*Joe:* Virtual reality for pain management?

*Dr. Klein:* Virtual reality is used as a non-invasive therapy to decrease pain symptoms associated with amputation. You may hear it referred to as "VR." Patients use a headset and are immersed in a virtual environment. The physician who is using this therapy experimentally should also be able to tell you much more about it. *(The physician hands over a business card with physician's info.)*

*Joe:* Thanks, Doc, I'll give it a try.

*Joe contacts the physician and starts the virtual reality therapy. He has a return visit in rehabilitation clinic with Dr. Klein three months later.*

*Dr. Klein:* Hi Joe, how has your pain been since I saw you last?

*Joe:* It's not gone, but it's much better. The pain is about 50% improved thanks to the VR treatment. I'm so relieved.

*Dr. Klein:* This is great to hear, Joe. How has everything else been?

*Joe:* Really good. I started back to work part time last week and things are going well there. I'm able to perform all my responsibilities on the factory line, so they're talking about putting me back to full time soon. And I've seen my grandkids every week—they love letting me chase them.

*Dr. Klein:* I'm so happy you're doing this well, Joe. Let's continue meeting every two to three months to check on your progress from a rehabilitation perspective. Also, please continue to visit your primary care doctor to control your risk factors for another skin wound.

*Joe:* Will do, Doc. Thanks again!

### Questions

1. Use reputable sources to look up more information on virtual reality (VR) and describe how it is or has been used in amputee rehabilitation.
2. Mirror therapy serves as the basis for VR therapy. Compare and contrast mirror therapy with virtual reality therapy.
3. How has VR been used in medicine aside from pain management?