

# A Bad Burn

by

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## Part I – Skin Anatomy

“White or blue shirt for my job interview today?”

Akeem had just finished his university degree in marketing and was preparing to meet with a recruiter from a Fortune 500 company later that afternoon. He held his cell phone in one hand while he talked to his brother, asking advice on what to wear. Akeem’s other hand rested on the ironing board near the hot iron he was readying for use. A knock at the door caused Scout, Akeem’s large dog, to bolt towards the door. In the process, Scout bumped the ironing board, causing the hot iron to fall onto Akeem’s hand.

Akeem shouted. He dropped his phone on the floor and fumbled to get the iron off his hand. Somehow, the iron had become tangled in the shirts and both were tangled with his hand, making this more difficult. Eventually Akeem’s flailing knocked the entire ironing board to the ground, taking the iron and pile of shirts with it.

“What happened! Are you okay?! I heard you scream!” Kamari, Akeem’s friend, had let himself into the apartment and rushed towards Akeem.

“I burned my hand!” Akeem yelled. He clasped his hand and held it near his body.

“Let me see it,” Kamari urged.

Kamari had just finished his nursing degree at the same university Akeem attended, and prior to that had worked for several years as an emergency medical technician (EMT). Akeem hesitated, then anxiously held out his hand for Kamari to see.

“That looks like a full-thickness burn. We need to get you to a hospital.”



You will likely need to use the figures provided, your textbook, and online resources to answer the questions included in this case study. A list of websites that you may find helpful is given in the “References” section at the end of the case.

## Questions

1. Label the epidermis, dermis, and hypodermis on Figure 1 (next page). Then label the sublayers of the epidermis and dermis.

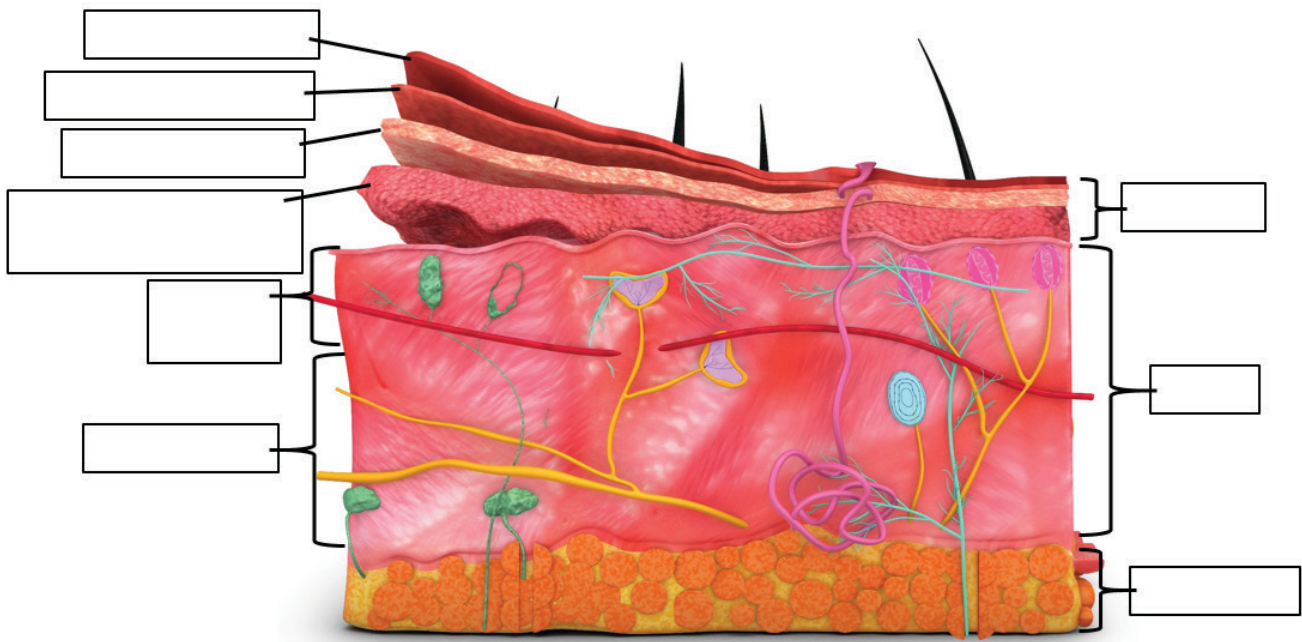


Figure 1. Structure of thin skin. Credit: ©7active Studio | Dreamstime.com, ID 39817225.

2. Match the sublayer of the epidermis with its description.

- |  |   |
|--|---|
| a. Stratum corneum                       | ___ Appears translucent under a microscope.   |
| b. Stratum lucidum                       | ___ Contains cells undergoing mitosis.  |
| c. Stratum granulosum                    | ___ Consists of heavily keratinized, squamous-shaped cells; resistant to abrasion.              |
| d. Stratum spinosum                      | ___ Includes immunocompetent Langerhans cells; epidermal cells look “spiky” under a microscope. |
| e. Stratum germinativum (Stratum basale) | ___ Cells secrete lipids and proteins, which create a hydrophobic barrier within the epidermis. |

3. Figure 1 shows the structure of the epidermis in “thin” skin, which is what covers the dorsum of the hand. How does thick skin (such as that found on the palm of the hand) differ from the thin skin shown in Figure 1?

4. The dermis consists of two sublayers (papillary and reticular), which you labelled in Figure 1. Compare and contrast the structure and function of these two dermal layers.



## Part II – Classification of Burns

“Burns swell really quick, so take your ring off,” Kamari directed as he helped his friend out to the car. “And try to keep your hand above your heart level as much as you can.”

Kamari drove Akeem to the nearest hospital, which was about 20 minutes away. As they neared the emergency room (ER) entrance, Kamari asked Akeem how he was feeling.

“Honestly, this doesn’t hurt like I thought it would,” Akeem responded. “The area around the burn feels painful and tight, but I really don’t feel much in the center of it.”

Once in the ER, Akeem was immediately taken back to triage. A nurse evaluated his injury, and then took him to a room to wait for the doctor. While they waited, Akeem noticed a chart with information about burns on the wall and began reading it.

### Questions

1. Research first-, second-, and third-degree burns. Use the table below to summarize information that you find about each burn type.

<i>Burn Type</i>	<i>Skin Layers Damaged</i>	<i>Characteristics</i>	<i>Potential Complications</i>	<i>Treatment</i>
First-degree				
Second-degree				
Third-degree				

2. When he first saw Akeem’s injury, Kamari indicated that the burn appeared to be “full-thickness.” What does that mean?



## Part III – Burn Treatment

After learning a little more about burns from the emergency room chart, Akeem had some questions for his friend Kamari.

“So it looks like I have the most severe type of burn. A third-degree burn, or what you called a ‘full-thickness’ burn. What happens next?” Akeem asked.

Kamari replied, “Normally, a severe burn is assessed by what is known as the ‘rule of nines.’ It’s a quick method for calculating the size of the burn, which needs to be known in order to plan for treatment. Basically, the rule of nines divides the body into sections that account for 9% of body area, or some multiple of 9%. For example, the entire head and neck is considered to be 9% of body area. The front of the head and neck is 4.5% of body area, and the back is another 4.5%, so all together 9%. If you came in with burns on the front and back of your head and neck, the doctors would quickly estimate that 9% of your body is burned.”

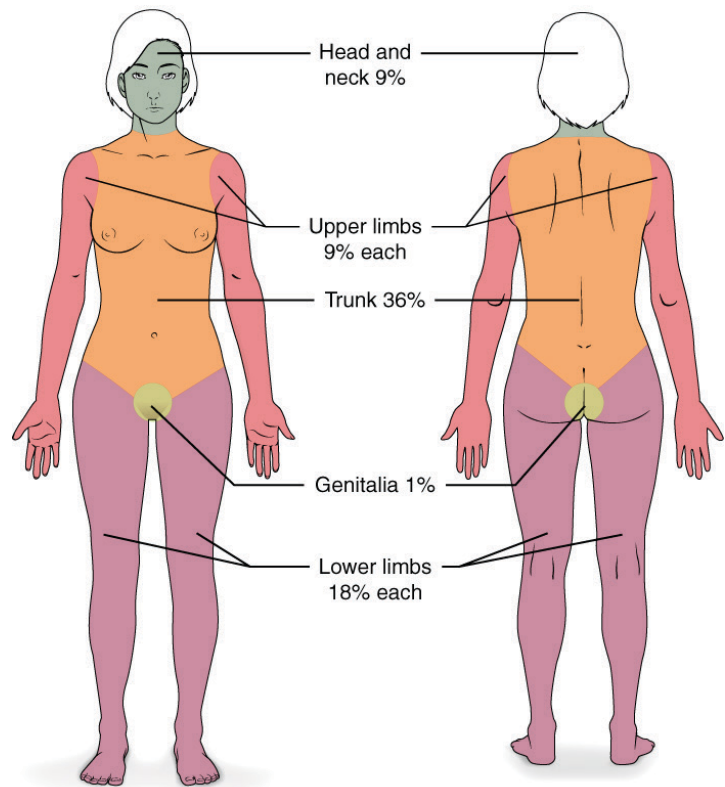


Figure 2. Calculating the size of a burn. Credit: Betts, J.G., et al. (2022). *Anatomy and Physiology, 2nd ed.* OpenStax. CC BY 4.0. Access for free at <https://openstax.org/books/anatomy-and-physiology-2e/pages/1-introduction>.

### Questions

- Suppose you are an ER doctor treating a patient, Mark, who has severe burns on his anterior lower limbs, genitalia, and anterior trunk. Use Figure 2 above to calculate the percentage of Mark’s body that is burned.
- Akeem has burns on just the dorsum of his right hand. Figure 2 does not provide enough detail to exactly calculate the size of Akeem’s burn, but what is your best estimate for the percentage of Akeem’s skin surface that is burned?
- Earlier in this activity, you learned that epidermal cells produce proteins and lipids that create a hydrophobic barrier within the skin. This barrier makes the epidermis impermeable to water; it keeps internal body fluids inside the body, and prevents external fluids from entering the body. One dangerous potential complication of a severe burn is dehydration and electrolyte loss due to destruction of this hydrophobic barrier. Internal body fluids and blood seep out of the wound site without the barrier intact. These fluids and electrolytes must be replaced as part of the burn treatment. Based on the size of their burns, who would need more fluid and electrolyte replacement during treatment, Akeem or Mark (the patient mentioned in Question 1 of this section)? Explain your answer.

“Hi Akeem. My name is Dr. Rodriguez and I’m going to be your provider today. I hear you have a bad burn.”

Dr. Rodriguez examined Akeem’s hand.

“You’re going to need a broad-spectrum antibiotic so I’ll get that ordered,” she said. “We’ll need to send you for an escharotomy, and I think we’ll probably want to do a skin graft. I’m going to refer you to our burn clinic for further evaluation.”

*Questions*

4. Why did Dr. Martinez order a broad-spectrum antibiotic for Akeem?
  
5. What is an escharotomy, and how is it done?
  
6. Do some research on skin grafts (including autografts and allografts) and use this information to complete the table below:

<i>Graft Type</i>	<i>Description</i>	<i>Pros/Cons</i>	<i>When to Use</i>
Autograft			
Allograft			

7. Which type of graft would be best for Akeem based on what you know about his injury? Be sure to justify your reasoning.

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