

CHAPTER 1

CHARLES WOODS

Courageous Survivor

Procedure: Burn treatment

Dates of Operations: 1945–1947

Institution: Valley Forge General Hospital, U.S.
Army, Phoenixville, Pennsylvania

MEETING CHARLES WOODS

When I first saw the young aviator, Charles Woods, he had no nose, eyelids, or ears, and his mouth—if you could call it that—was a raw opening. He had been terribly burned, burned beyond recognition and was weak from infection, loss of body fluids, and malnutrition. Burns covered more than 70% of his body, including his entire head and hands.

According to studies of many patients with equally serious burns, Charles Woods should not have lived more than a few minutes after the fire. But it was now six weeks later, Charles had been airlifted over 10,000 miles, and he was still holding on to life. He had arrived at Valley Forge General Hospital, an Army hospital in Phoenixville, Pennsylvania. His fingers and tendons had been fused and encased in fragile, immature scar tissue. His face had been erased by fire. Charles Woods was a human form—one whose age could not possibly be determined from his appearance. In fact, he was 22 years old. What awaited him over the next two years was a series of 24 operations, many conducted with only minimal anesthesia, and unimaginable pain. A team of surgeons was going to try to build him a new face and functioning hands and to give him back his life.

At age 25, I was the most junior member of the team. The questions raised and lessons learned in trying to help Charles would determine the course of the rest of my professional life.



Young aviator Charles Woods before his accident.

CHARLES' STORY

Charles Woods' injuries were anything but routine, and so was the manner in which they were incurred. From early childhood, Charles' life ambition had been to fly. Brought up an orphan in Alabama, he first enlisted in the Canadian Air Force until the United States entered World War II, when he joined the U.S. Army Air Corps. After an illustrious career in Europe and Africa, he returned to the States and requested further duty. He was then sent to Burma and assigned to fly the "Hump" into China, ferrying supplies for the Allies' Flying Tigers to help the Chinese army fighting against the Japanese in Mainland China.

Flying the Hump meant filling the huge containers attached to the bottom of his airplane with a cargo of 28,000 pounds of aviation fuel and then flying that fuel from Kurmitola, India, where he was stationed,

to Lulaing, China. There was nothing direct about the route. The Himalayan Mountains boast some of the most treacherous terrain in the world, and that distinction does not end at the mountaintops. The steep, jagged peaks did strange things to the surrounding air, and Charles would find himself wrestling surging updrafts, then suddenly fighting to break free from powerful wind shear. Add to these conditions weather that was often inclement and an airplane made cumbersome by a heavy load of fuel, and you have the potential for disaster.

But that was not the way Charles saw it. He flew the Hump every day, untroubled by the rigors. Flying was what he wanted to do and, in a way, flying the Hump was flying at its best. It required every bit of concentration and skill he had, and Charles proved his abilities with the completion of every safe passage. This held true for as long as he was the one in control of the plane.

At 22, Charles was young to be an instructor pilot responsible for training other pilots. But his “natural born” flying abilities were recognized early by his superiors, and Charles advanced quickly—as much out of need as of talent. Fighter-bomber pilots in Europe experienced substantial losses. Their average combat life expectancy was 56 flying hours. With every mission, 11 percent of the planes were lost. With pilots normally flying two missions a week at the height of the bombardment, a pilot’s life expectancy was 30 days. For those pilots flying the Hump month after month, the average loss was 100 percent of the planes every 90 days. As Charles recalls,

I tried not to think about it. I accepted it as part of my job, and when I was told to fly, I flew. And I flew a lot. We averaged from 140 to 150 combat hours each month. In comparison, a commercial airline pilot in the United States today is grounded after 100 hours. I remember being so sleepy when flying that airplane that at times I hoped we would hit a mountain. I was so tired that even *eternal* rest seemed preferable to no rest at all.

There is a strong camaraderie among fighter pilots worldwide, but our casualties were so high that the pilots in our group tended to keep to themselves. With hindsight, I realize that we didn’t want to risk becoming friends with someone only to have him disappear the next day. We did little socializing at the Officers Club; we were just too tired. We ate, we slept, and we flew.

On December 23, 1944, Charles was preparing to take the trip he'd made hundreds of times before. But this time he had a passenger. Captain Stalmacher would be flying first seat as pilot-in-training to test whether he could fly the tricky passage on his own.

I had a habit of saying a simple prayer before each takeoff: "Dear God, please be with us." The day I took off with Stalmacher . . . , this prayer was more fitting than I could know. Stalmacher made a fatal error on takeoff. Mistakenly thinking the plane was airborne, he applied the brakes to stop the wheels from spinning. Getting the plane airborne was now out of the question. One hundred and twenty mph was the minimum requirement to get off the ground, and Stalmacher's act lowered the speed to 90 mph. We had slightly over 100 yards of runway remaining. I knew we'd "bought it." I remember telling myself that if I could only stay conscious, I could get out of this mess.

I assumed command and took the only prudent course of action available: I pulled power and put my entire body weight against the brakes. Stalmacher and I both fought the controls as the plane plowed into the soft dirt at the end of the runway. The plane fishtailed, then slowed to a near stop before crossing paths with the sharp branches of a fallen tree. I yelled a warning to the flight crew, "Let's get out of here." But it was too late. The fuel tank was pierced, and a single spark was followed quickly by an explosion. The plane and all of us inside it were instantly enveloped in flames.

I felt a first blast of heat, then my nerve endings must have seared because I lost all feeling. I knew what I had to do and I did it. I stayed calm and kept my eyes shut tight, hoping to protect them. I felt for the small Plexiglas window beside me, opened it and twisted through and slid down the fuselage. The plane was tipped over on its wing. I could hear the big old propeller still ticking over, and I knew I had to stay clear of that. I landed hands-first in a puddle of flaming gasoline, then ran until I could no longer sense the intense heat from the plane. Natives rushed out to help put out the fire that was consuming me. I discovered much later that they helped themselves to my watch and wallet as payment for their troubles.

As was the case with many aviators during World War II, Charles had removed his helmet and gloves prior to take-off because they impeded

his fine-motor control. The consequences of that action were frightfully severe. When he was suddenly engulfed by flames, his face and hands were unprotected. They were severely damaged, and his life hung in the balance.

THE LONG TRIP HOME

Charles was given some medical treatment in Burma, and plans were made for his return to the United States for follow-up care and more definitive surgical treatment. Military transport had progressed to the point that Charles could be moved quickly. Already a hero because of his courageous flying record, he was granted coveted Priority One status. Even so, his transport took six weeks. "I was so weak," Charles says. "I could only fly one day, then I'd have to rest up in a hospital somewhere for a week."

One of those rest stops was in Calcutta, where he was put in a corner to die. "I kept telling them that if they'd just send me to the United States, I would live," says Charles. Finally, after two weeks, they sent him on his way. But the trip home almost ended in Cairo. "It was there they took me off fluids," Charles remembers, and his voice still retains barely controlled rage as he describes the experience.

They kept pumping water into me, and I was so weak and sick I kept throwing it right back up. One of the more junior doctors told the nurse to take me off fluids. It was like signing my death warrant. I begged for water. I tried to explain why I needed it. Fluids were oozing out of 70 percent of my body. I quickly dehydrated. With no saliva in my mouth, I could no longer speak. I slipped in and out of consciousness. I dreamt of deserts, and mirages without water. It was a nightmare then, and I still have nightmares about it to this day. Finally the more senior charge doctor returned, stunned to see what had happened to me. He placed a teaspoon of water in my mouth, and again gave orders for fluids. He was the one who had the sense to assign a full-time nurse to travel with me to the United States. Even so, I continued to deteriorate on the endless flight over.

Military transport planes were not designed to cradle their passengers in comfort. The rough ride took its toll on Charles, and when he finally arrived at the Army hospital in Pennsylvania, he was teetering on the edge of life.

TAKING CARE OF CHARLES

The surgical team charged with the care of Charles Woods was made up of Dr. James Barrett Brown, Dr. Bradford Cannon, Dr. Andrew M. Moore, and me. Drs. Brown and Cannon supervised Dr. Moore, who was responsible for Charles' day-to-day care on the Officers Ward, and I assisted Andy. Some of the things we had to do were obvious. Top priority in the treatment of burns is making sure the airway is kept clear. Because burns of the breathing tubes—the trachea and bronchi—and lungs cause so much swelling of the air passages, a burn victim can suffocate within minutes. Once a functional airway is established, the chief threats to life are fluid imbalance and infection. Replacement of skin is critical for controlling both.

The first order of business for Charles, in addition to controlling infection and limiting fluid loss, was to cover the burned areas with skin as rapidly as possible. This involved taking (or “harvesting”) pieces of healthy skin from an area of the patient's body that had not been burned (called the “donor site”) and transferring them to the burned area. Such transplants are called skin “autografts” because the transplanted tissue is from the same person and will therefore not be rejected by the immune system. Technically, the only other possible kind of autograft would be tissue obtained from a patient's identical twin. In fact, years earlier, Dr. Brown had published a report describing the first successful skin graft in which the donor and recipient were identical twins. Unfortunately, Charles had no twin.

In some cases, using a burned patient's own skin is not possible, for example, if the person's burns are so extensive that not enough healthy skin remains for harvesting. Even if enough healthy skin is available, the patient may be too sick to undergo autografting. This was surely the case with Charles, who was far too malnourished and debilitated from infection to withstand the operation required to harvest the skin grafts we needed. As a stopgap measure, Dr. Cannon decided that we would use skin grafts from a cadaver, and he called the next of kin of a recently deceased patient to get the necessary permission for the donation.

Tissue transplanted from one individual to another is called an “allograft.” I had little hope that this type of graft would survive for long, since it was well known that an allograft recipient's immune system eventually rejects transplanted tissue such as skin. For the first seven to

10 days after skin is transplanted, an autograft and an allograft look the same: pink, healthy, and viable. However, after 10 to 14 days, the allograft starts to fray around the edges, and within a week or so it begins to shrink until it disappears completely. In contrast, the autograft not only maintains its original size, but it starts to expand around the periphery and creep out in all directions, ultimately covering a much larger area than it did when first transferred.

In Charles' case we were forced to use an allograft, meaning that we could hope to buy only 10 to 14 days before we would have to find another solution to the problem of coverage. But, to our



The anesthesia was given through the tube coming from Charles' right nostril. Nasal intubation was rare in civilian life but routine at Valley Forge General Hospital.

amazement, the allograft continued to serve adequately for about a month. During that crucial reprieve, Charles' nutritional status improved and the infection subsided. We were then able to start replacing the now failing allograft with skin taken from unburned parts of Charles' own body. Because his burns were so severe, total coverage required many operations.

Our team developed an efficient operating routine. While either Dr. Brown or Dr. Cannon worked to restore Charles' facial features, Andy and I used tweezers to position the little squares of new skin on the hands. All newly placed skin had to be covered with dressings, which were replaced each day. These daily dressing changes were painful but necessary to prepare the recipient sites for subsequent skin grafts. What we were doing was analogous to planting seeds, optimally preparing the "soil" to accept and "grow" the precious pieces of skin.

After weeks of dressing changes and several additional skin donations from the cadaver, Charles' wounds began to heal, and he began to gain weight. Soon all the burned areas had healed. By that time we knew that he would live but his injuries would still result in a devastating number of surgically challenging deformities—more than any of us had ever seen.

“RECONSTRUCTING” CHARLES

When planning for Charles' long-term reconstruction, we gave highest priority to replacing his eyelids. Since the unprotected eyes were in danger of infection and subsequent loss of vision, careful dressings, antibiotics, and ointments had to be used to protect the eyes 24 hours a day to prevent irritation, further injury, and drying and destructive loss of the cornea. We released the scar contractures of his eyelids by cutting



Operating room photo showing skin allograft already in place. According to Dr. Cannon's logbook, Charles underwent a total of 24 operations.

across the fibrous tissue, allowing the lining to drape over the eyeball itself. Skin grafts from unburned areas around his collarbone (the clavicle) were used to cover the areas exposed by the incisions and to reconstruct both upper and lower lids. The color match was satisfactory, and the pliable tissue allowed Charles to open and close his eyes. This use of clavicular skin to cover the eyelid surface was just one of many outstanding medical innovations developed during World War II.

We performed these early operations under general anesthesia. At one point, mid-operation, Charles' heart stopped. Because we had such trouble restarting it, we wor-

ried about the risk of using general anesthesia again. Instead, we tried to get by using as little anesthesia as Charles could stand in the form of local anesthetic or sometimes no anesthetic at all. Consequently, every operation Charles underwent from then on caused our courageous patient considerable pain. I remember one procedure involving the eye in which we could use only numbing drops. We strapped his arms down with sheets and had two nurses lie across his body to keep him still. Although the operation was mercifully short, Charles moaned for well over an hour afterward.

About a month later, after we had repaired Charles' eyes, we turned our attention to releasing the scars around the corners of his mouth. Conceptually, this step was intended to enlarge the surface area of skin covering his face

to allow the underlying muscles and nerves to function better so that Charles could open and close his mouth. We did this in stages. Since burn scarring contracts the skin in all directions, we had to incise the scars on both sides of his face, from the corners of his mouth all the way up to his ears (or rather to his ear canal, since both ears had been burned off).

Cutting these thick scars was somewhat like cutting an elastic band. Once the cut is made, the freed ends retract, leaving a crater of raw tissue that must be filled in and covered. To achieve this, we obtained



The burned areas are shown covered completely with new pieces of skin. The eyelids have been partially reconstructed to protect the corneas. The nose has not yet been rebuilt, and the mouth is tightly constricted due to loss of a flexible "skin envelope." As part of a multistage procedure to expand the skin envelope, autografted skin has been inserted in the horizontal scarred areas at the sides of the mouth. Various skin autografts form a patchwork of still immature tissue grafts.

multiple pieces of skin from Charles' flank and the hairless parts of his thighs.

The next priority was to create a new nose for Charles. This was done using a rectangular flap of arm tissue, roughly 4×7 inches. Unlike the small pieces of healthy skin that could be removed from the unburned areas of Charles' body to cover the burned areas, the flap of tissue from his arm could not be detached immediately, since the tissue required a steady blood supply to remain viable. As we attached the loose end of the arm flap to Charles' face, we had to position the donor arm close to the point of attachment and secure it there until the skin from the flap "took" and started to attract its own blood supply. In Charles' case, this process took 22 days. Finally, the flap that would become his new nose could be cut free from its anchor on his arm.

After about nine months, Charles' eyes had healed to a point where the bandages could be removed. Understandably, one of the first things Charles asked for was a hand mirror. But despite his several requests, there was a surprising absence of compact mirrors in the nurses' pocket-books. Finally, he dragged himself to the bathroom mirror. As a surgeon, I was able to look at the misshapen mass that was then Charles' face and envision what I knew it could be. But Charles did not have the training to perceive it that way. What he saw must have alarmed him—an uneven patchwork of skin, a tiny hole of a mouth, and a mound of flesh for a nose that looked like a three-year-old child's first attempt at molding clay. Whatever Charles thought, he said nothing. Instead, he just dragged himself back to his bed, curled up, and went to sleep. It was a sensible response, for he would need all the rest he could manage to make it through the months-long reconstruction process.

Using our now standard operating routine, the four of us continued to work as a team. While either Dr. Cannon or Dr. Brown fashioned Charles' nose, Andy and I began reconstructing what was left of his hands. He had lost the tips of all his fingers and both thumbs. It was during these operations that I learned the difference between fine and gross surgical reconstructive maneuvers. Knowing when to use one or the other was an important judgment call. In Charles' case, Dr. Brown's instructions were clear: "Just try to release all of those bones and tendons that are entrapped and create as much raw surface as you can. Give as much motion as possible." So Andy and I would cut away through layers of scar tissue that was devoid of identifiable normal anatomic structures. We did our best to create finger-like structures

from the bones and muscles of the palms of the hands and then covered all the exposed surfaces with skin taken from wherever we could find an intact donor site.

“I knew that I wouldn’t be able to eat for a week after each of those operations,” Charles remembers. Determined not to become addicted to drugs, he gritted his teeth through the pain. A typical course of morphine administered at our hospital was one shot every 4 hours, for a total of 6 shots per day. Charles prides himself on never having had more than four shots per day throughout his entire stay at Valley Forge.

CHARLES GOES HOME

After 24 operations and a year and a half spent at the hospital, Charles was pronounced “healed.” He had eyelids to protect his eyes, could eat, and was able to use his hands for most functions. Charles’ recovery was made possible by a combination of many things. Good medical care, to be sure, but equally important was the efficiency of the military transport system in getting him halfway around the world, and the good sense of those in charge to assign him to a hospital equipped and prepared to care for him. In Charles’ case, these logistics of patient management were critical to his survival. Overriding all of this, however, was Charles’ determination to live, and his strong faith in God.

Charles returned to Alabama and became a successful businessman. Recognizing the need for homes for returning veterans, he parlayed a small loan and his building know-how into a thriving construction business. He later recognized the importance of the then new medium of television and saved enough money to buy a television station. To this he soon added another, until he owned more than a dozen stations throughout an area that stretched from the mid-South to the West Coast.

In a way, Charles’ story has come full circle. He is now involved with setting up a system whereby the latest medical information and technology will be available worldwide 24 hours a day via three uplinks: one in San Diego, California; one in Charlottesville, Virginia; and a third in San Tau, China, where Charles was honored 50 years later by the Chinese government for his efforts on their behalf during World War II.

Over the years, I have seen Charles more or less regularly. He would on occasion return to the Boston Veterans Hospital, where Dr. Cannon and I would make small improvements in some of his scars and enhance the function of his eyelids, mouth, and hands. As plastic

surgery techniques advanced, we offered to refine his appearance, but Charles didn't feel it was necessary. With characteristic good humor, he remarked, "Oh, they could put me in some eyebrows, and they could make me some ears, and they could give me some lips that work better. But I'm so used to myself it's not worth the trouble now." Today, when asked whether he would like his original face back, Charles responds with an emphatic "NO!" He contends that he has learned much and benefited greatly from his ordeal.

Charles continues to have an impact on medical knowledge. In 1989, Dr. Cannon and I invited him to give a talk to the first- and second-year Harvard Medical School students. He began his speech by telling them they were among the most fortunate persons on earth, with a tremendous future before them. As he retold his dramatic World War II story, he was not in the least bit heroic, stressing instead the need to keep one's head in time of crisis. (As impressive as his many military medals are, Charles told me recently that they didn't mean much at the time they were awarded: "We didn't pay much attention to the decorations back then. They'd send you a certain medal for so many missions or



A recent photo of Charles, in all his glory.

something like that, and you'd stick it in your baggage and wouldn't hardly give it a thought because almost never did you see anybody wearing a medal overseas. You wore your wings and your rank and that was it.") His story had quite an effect on the open-mouthed students. Here was a 67-year-old man who, though severely disfigured, had obviously been successful in both business and his personal life, an ebullient optimist who unabashedly relied on God for everyday guidance.

Charles has never considered his appearance a handi-

cap. As a matter of fact, he points out that it has proved useful in at least one respect—no one ever forgets meeting him. “They always know me at the bank,” he jokes. Sometimes his competitors assume that he’s not very bright, which has given him a certain advantage. According to Charles, one of his greatest satisfactions was realizing that his competitors had tried to cheat him and were thus treating him as an equal.

When Charles asked one of his young sons what his friends at school thought of their father, he steeled himself for what he expected to be unkind words. But they never came. “They think you’re magic, Daddy,” his son said to him. And reflecting back upon his incredible recovery, I realize that some part of that statement must be true.

THE IMPACT OF CHARLES WOODS ON MY LIFE

As with any discipline, surgery is always building on lessons learned in the past. All the surgical procedures that we performed on Charles Woods previously had been pioneered by others—in some cases, centuries earlier. For example, when we used a flap of tissue from Charles’ arm to rebuild his nose, we were using an established reconstructive technique first described by Tagliacozzi in the late 1500s. During that period in Italy, a common form of punishment for crimes such as stealing or adultery was to slice off the offender’s nose. Not surprisingly, a group of skilled technicians devised ways to reconstruct the missing appendage.

Although the field of reconstructive surgery was not new, Charles Woods was my introduction to it. At the time, the rebuilding of the face and other external parts of the body to correct deformities was not highly regarded within academic surgery and thus had relatively few practitioners. Most surgeons removed or repaired diseased organs *within* the body. Yet caring for Charles Woods instilled in me a fascination for reconstructive surgery. Charles became the first of hundreds of patients whom I was able to help through reconstructive surgery—people with terrible deformities, either from birth or through some accident later in life.

Charles Woods set the course of my professional life in another way. In caring for Charles, we used skin from a recently deceased person to temporarily cover his burns. Although this was a well-established technique, it was new to me—and it had a lasting impact. Charles was my introduction to the use of tissues from one person to save the life of

another. As in Charles' case, the only tissue that had ever been transplanted from one human being to another was skin, and that worked only briefly. In fact, basic scientists were pessimistic about the feasibility of human transplantation. For example, in his book *The Biological Basis of Individuality*, Dr. Leo Loeb categorically stated that transplantation between individual humans would never be possible. Although his thesis was accepted as dogma by some, it did not seem irrefutable to me. Surgeons by nature tend to be optimists.

I began to wonder whether it would ever be feasible to go beyond skin. Would it someday be possible to remove a healthy internal organ from a recently deceased person and transplant it into a person in whom that organ was failing? Might we eventually harvest one of a pair of vital organs, such as a kidney, from a healthy person and transplant it into a person who would otherwise die? The challenge posed by such questions was obvious. The immune system rejects tissue that it recognizes to be foreign, and the transplanted organ would not last. Yet, in the case of Charles Woods, the skin transplanted from another person had surprised us by lasting nearly a month before being rejected.

That was a puzzling observation. I now believe that Charles' weakened physical condition probably depressed his immune system and therefore postponed rejection. At the time, however, I had no idea why the transplanted "foreign" skin had lasted. One thing was clear, though, and the notion kept returning: perhaps the immune response could be controlled! Perhaps there were tricks we could learn that would one day allow us to prevent the rejection of transplanted organs. As I continued to ponder that possibility, my career began to take a new direction.

In his book *The Art of the Soluble*, Sir Peter Medawar, Nobel Laureate and the acknowledged dean of transplantation biology research, stresses the importance of picking the right subject for research. As it turned out, I had picked an appropriate subject. In Boston, Massachusetts, on December 23, 1954—10 years to the day after Charles Woods was enveloped by a ball of fire in Kurmitola, India—our team transplanted the first internal organ, a kidney, from one living human being into another.

Thus, Charles Woods led me to pursue both reconstructive surgery and what has become the field of "transplantation surgery"—the two fields that have been my life's work. I feel blessed to have had a career full of trying to solve puzzling intellectual challenges and of helping patients. Charles is aware of the role that he inadvertently had in the history of



Charles 40 years later, completely healed, talking with Harvard Medical School students. His hands had been made sufficiently functional to allow him to return to flying, which he only recently gave up at the age of 70.

human organ transplantation and even now, whenever he hears of a successful transplant, he feels a certain satisfaction: “I feel I had a small part in it, just by laying still on that table and letting Dr. Murray cut on me.”

I am pleased to have been able to help my patients, but so often my patients have given me much more than I have given them. Such was the case with Charles Woods. First, he taught all of us who cared for him how a will to live can overcome enormous odds. There is no scientific explanation for his nearly miraculous survival, and there does not need to be. Second, Charles taught us about physical and emotional courage. For two years, he suffered unimaginable pain. On occasion, he moaned or cried, but he never complained. Charles also taught us about a deeper kind of courage. We reconstructed what we could of his body, to the point where he could function normally—could eat, could talk, could blink his eyes, and use his hands to fly an airplane again—but he still looked like no one you have ever seen. When we were through, Charles looked in the mirror, walked out into the world, and built a life full of accomplishment and happiness.

As remarkable as he is, Charles Woods is not alone. Since caring for him, I have cared for hundreds more like him: people struck down by misfortune, people who make a life for themselves with enormous dignity. This book is not just the story of my life. This book is also about them.