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To Grasp a Handle, Open a Jar, Hold a Fork

A surgeon restores the hand of a young Iraqi woman injured by a terrorist bomb.

NOORA AL-SARIAA, 27, a striking young woman with dark, shoulder-length hair, brown eyes, and a ready laugh, struggles a bit with English. So she sometimes expresses herself with her graceful hands. The bomb injury that left one of them functionally useless just over a year ago is barely noticeable now.

On the morning of August 19, 2009, a truck bomb exploded in front of the Iraqi Foreign Ministry in Baghdad, where Noora worked in the legal department. The blast was one of a wave of bombings just minutes apart that also targeted the Iraqi Finance Ministry. The coordinated attacks were later attributed to Baathist supporters of the hanged Iraqi leader, Saddam Hussein. Fifty-two of Noora's colleagues died and at least 400 were injured.

"I was on the fourth floor, working on a new draft of a treaty," she recalls. "Suddenly, I lost my hearing. I could see for a couple of seconds and then the dark came. I lost consciousness, so I can't remember everything." A colleague found her and carried her out of the building to a public hospital crowded with the injured and dying. The bomb blast had shattered her left humerus, the long bone in the upper arm, and severed her ulnar nerve, an unusually long nerve that travels from the collarbone to the hand and partially controls hand motion and sensation. Close to the surface of the skin at the elbow, the ulnar nerve is responsible for the brief tingling pain when the "funny bone" is hit. A spray of glass shards had hit her left side, embedding in her trunk, shoulder, back, and arm.

Her mother's cousin pulled strings to send the young woman to a special hospital in Amman, Jordan. There surgeons took a bone graft from her hip to fill in the bone defect in her upper arm and attempted to repair her injured ulnar nerve.



Noora Al-Sariaa (left) and surgeon Mihye Choi, MD.
(Photographs by Sasha Nialla)

But after the surgery and a month of rehabilitation, her left hand remained frozen in a claw.

In January of 2010, less than six months after the bombing, Noora arrived in New York City to work with the UN Security Council's Counter-Terrorism Committee as part of the Iraqi Mission to the United Nations. "When I came here, I still couldn't use my hand," she says. A sleeve pushed back above her elbow reveals a Z-shaped scar, a consequence of her injury and multiple surgeries.

Through the efforts of another relative, Noora met Hiyad Al-Husaini, MD, a general plastic surgeon from Iraq who practices in New York. “Noora had a very bad injury with significant damage to her ulnar nerve, and she was not improving,” Dr. Al-Husaini says. “If we left her like that she would lose functionality of the left hand. So I decided to refer her to someone who could give her the best treatment.”

That someone was Mihye Choi, MD, assistant professor of surgery and a plastic surgeon with expertise in nerve reconstruction at NYU Langone Medical Center, under whom Dr. Al-Husaini had worked as a fellow.

When she met her new patient, Dr. Choi recalls, “She couldn’t really grasp anything. She could not make a fist. She couldn’t carry anything or open a door.” Noora’s initial injury was compounded by the fact that the previous surgery to repair her ulnar nerve had left a walnut-size knot of scar tissue blocking the path for new nerve fibers to grow. As a result, the nerves in Noora’s forearm had all degenerated, causing the muscles in her hand to atrophy. “There was no active impulse going through, no electrical signal distal to the injury site,” Dr. Choi says. “The challenge for me was not only to reconstruct her nerve but to improve her hand function immediately.”

She proposed microsurgery to remove the scar tissue and then bridge the gap by borrowing a nerve from Noora’s leg, the sural nerve, which provides sensation to the outside of the ankle and foot. “Even though it’s a sensory nerve, without motor function, it still works and serves as scaffolding for new nerve fibers to go through that gap.” Aware that nerve regeneration often takes time and is often incomplete, Dr. Choi also wanted to reroute the tendons in order to improve hand function quickly.

The scope of the proposed surgery was daunting and the young woman initially refused. “I was afraid. I’d already had three surgeries,” she says. Undeterred, Dr. Choi subsequently enlisted the help of Dr. Al-Husaini and a translator, and met with Noora many times to describe the surgery. Noora finally agreed and in July 2010, she underwent the six-hour surgery.

First, orthopedic surgeon Nirmal Tejwani, MD, removed the stainless steel plate and screws from the bone graft surgery to the humerus in her upper arm, which X-rays showed had healed. Once the plate was removed, Dr. Choi stepped in to do the nerve grafting under an operating microscope, dissecting the damaged nerve and examining it slice by slice. “We look for nerve fibers that are viable so that we can cut out the injured segment and put the new nerve in its place.” The goal was to repair the nerve so that new fibers could grow to the appropriate muscles and to sensory receptors in the skin.



After six hours of microsurgery, Noora's hand function improved, and today she can grasp objects.

Microsurgery is demanding and requires tremendous precision. Like an insulated electric cable carrying a thicket of wires, nerves are wrapped in layers of myelin and contain fibers for both motor and sensory neurons. The surgeon must differentiate between them by using an electric current, and she must also examine each nerve under a microscope to properly locate distinctive groups of fibers.

If the nerve fibers grow into the wrong channel in the nerve sheath, then motor fibers may grow into a sensory nerve ending and function will not be restored. “They’re not color coded, you need to go by anatomical landmarks like blood vessels,” Dr. Choi says.

Additionally, adults are not the best candidates for nerve reconstruction; children are. While any nerve can grow new fibers, regeneration is usually incomplete in adults, says Dr. Choi. “If you have one nerve with a thousand fibers, only a small percentage of those fibers will grow back. Success decreases with age.”

To improve Noora’s ability to grasp as soon as possible, Dr. Choi performed a tendon transfer. “Each finger has duplicate tendons,” she explains. “So we borrowed from the index finger and the long finger to make the thumb, the ring finger, and the little finger work.” To avoid an obvious scar on top of the hand, the tendon transfer surgery was done through an incision in the palm.

By Thanksgiving, the young woman’s ulnar nerve was rapidly growing back.

Noora says she could never have received the same level of medical care in Iraq. “The top doctors have left, many scientists have left because of Saddam and the war,” she says. “When I see Iraqi people injured every day—with no doctors to treat them—I feel fortunate to have come to New York City.”

Shrugging off the bombing and her injuries as things of the past, Noora describes her plan to become an ambassador and work on Iraq's big issues: fostering economic security, building democracy, and fighting terrorism. Her mother, Fatima, a housewife, and her youngest brother, 10-year-old Jaafar, visited her in New York recently. Despite the ongoing violence in Iraq, the young woman's family prefers to remain in Baghdad, where her father is an electrical engineer. Of her other two younger brothers, one is a teacher in Baghdad, and the other is studying computer programming in college.

Noora herself likes the American way of life. She's taking an advanced Berlitz course in English and hopes eventually to earn a doctorate in law.

How is her hand today? "I'm satisfied," Noora says. Now she can grasp and carry objects and make a fist. "It feels normal." •

—AUBIN TYLER

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