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Victims of MS get risky solution

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Three years ago, Justin Sears was a carefree college student whose hands mysteriously started to shake when he tried to use his computer keyboard.

The tremors were sporadic at first, but grew increasingly severe. He tried to ignore what was happening to his hands, but he soon started having trouble with his balance. Before long, he couldn't even climb stairs.

He was diagnosed with multiple sclerosis (MS), a chronic, neurological disorder that affects 350,000 Americans and is characterized by damage to the nerves in the brain and spinal cord that becomes worse over time, leading to spasticity or paralysis of muscles.

But his disease seems to have been put on hold, thanks to a new and controversial stem cell therapy that he received at Northwestern Memorial Hospital.

Over the last 20 years, the transplantation of bone marrow stem cells revolutionized the treatment of leukemias and other cancers.

The revolution is gradually moving to autoimmune disorders such as multiple sclerosis, lupus, rheumatoid arthritis and Crohn's disease. But with that promise comes a cost: The stem cell therapy can be fatal, while MS rarely is.



Justin Sears (right) rides a bus home last week after classes at Moraine Valley Community College in Palos Hills. Sears, 25, of the South Side, returned to college after receiving stem cell transplants.

Tribune photo by Stephanie Sinclair

Stem cells, the master cells that make blood, are retrieved from a patient's bloodstream before therapy and then returned to the same patient, a process known as autologous transplantation.

Although stem cells are found in larger numbers in bone marrow, removal from the bloodstream is easier, less costly and does not require general anesthesia. When re-infused into the bloodstream, they migrate into the bone marrow and—if the therapy is successful—produce a new immune system.

Such transplants demonstrate the regenerative behavior of stem cells—either from a stranger or from oneself—and

their power to heal. They provide most of the hard evidence behind the stem cell revolution that has swept through science and is being debated in Congress and in countries worldwide.

Now 25, Sears, of the South Side, is back studying psychology at Moraine Valley Community College in Palos Hills. His symptoms have subsided. His future looks much brighter.

"I can write with a pen again," he said, ticking off the improvements. "The hand tremors are much better. I can butter my own bread and eat soup, which I couldn't do before. I can climb stairs again.

"Before, I couldn't walk a hundred feet. Now, I can walk for miles."

Nobody knows what causes MS, but it seems triggered when the body becomes allergic to itself and the misdirected immune system attacks the central nervous system—specifically, the myelin sheaths, the thin layers of fatty cells that wrap around and insulate nerve fibers of the brain and spinal cord.

Repeated attacks bring about a loss of the protective coating of myelin, which halts nerve cells from communicating much the way that frayed electrical wires short out and stop carrying current. MS is acripler, not usually a killer, but the progression of the disease cannot be predicted and depends on the individual.

Northwestern Memorial has pioneered stem cell transplants for this and other devastating neurological disorders. Dr. Richard K. Burt, the hospital's director of immunotherapy, performed the first procedure in the U.S. in 1997. Based on the program's success so far, the National Institute of Allergy and Infectious Diseases awarded the hospital a \$9.2 million contract for further research on stem cell transplants for autoimmune diseases.

Sears received his transplant in January 2001. After doctors removed stem cells from his own blood, they killed his immune system, which had turned into a renegade, and then returned the healthy bloodmaking cells to his body.

The cells set up shop and built a new immune system that didn't attack his myelin.

Sears was hospitalized for three weeks. The transplant cost \$85,000, and Medicaid paid. If resetting the young man's immune system stops further damage from MS, the long-term costs of the disease would make stem cell transplants a bargain.

Sears' initial diagnosis, frightening as it was, was confounded even more because specialists could not predict what would happen to him.

Symptoms of MS may be mild—numbness or weakness in the limbs, blurred vision, clumsiness—or severe, such as paralysis, loss of intellect, blindness. About 70 percent of patients experience problems sporadically over several years—the "relapsing-remitting" form of the disease—but in others it progresses rapidly, leaving them bedridden, confined to a wheelchair or dead within 10 years.

Faced with such uncertainties, the MS research community is conservative and suspicious of any new therapy.

Studies of stem cell transplants for MS have involved small groups of severely disabled patients at research hospitals, and the evidence is mounting that the new treat-

ment is safe. Trials are getting under way to test its efficacy and compare that to accepted treatments.

Researchers, like Northwestern's Burt, worry about raising false hopes.

"We recently completed our study of 29 patients, and in most of them the tests suggested no further loss of myelin," he said. "We seem to be holding the disease in check."

"On the other hand, despite the transplant, some of our more severely disabled patients continued to deteriorate. We may have stopped the further loss of myelin, but for them it didn't seem to matter.

"I think when people reach that point, there's something else going on. MS may actually be two diseases. When too many nerve cells have been destroyed, our stem cell therapy is like closing the barn door after the horse has left."

Doing the transplant earlier, though, brings a formidable ethical problem.

"We want to do this in people who are having acute attacks, before the long-term damage can accumulate," Burt said. "But this is a very dramatic, potential life-threatening therapy. And we'd be doing it on patients who otherwise might do well on ordinary treatment."

"Bone marrow transplants are ethical in cancer, which is a fatal disease. But MS rarely is fatal. So the ethics here are really tricky."

The Northwestern Memorial results fall in line with those reported by other institutions, where as many as 85 percent of transplanted MS patients seem to be doing better.

"Preventing people with MS from becoming disabled—that's the goal," Burt said. "No other therapy has done that. But it's still too early to say if stem cell transplants can prevent disability."

One of the first patients in the world to have the transplant before she was physically disabled was Air Force Capt. Deb Strand, a critical care nurse, who lives near Olympia, Wash.

"Because of MS, my life went to hell in a year and a half," she said. "I lost my job, my career, my nursing license—I had cognitive problems, started to stutter and couldn't remember patients. My IQ dropped from 130 in college to 87. I had to retire from the military."

She did research on the Internet, discovered Burt and came to Northwestern Memorial in July 2000. Her transplant was on Aug. 11—"that's when I celebrate my birthday," she said. "That's the day my new life began."

She still has problems, she admits.

"But nothing has progressed. Nothing has gotten worse. The transplant is not a cure-all; it's not like my MS has gone away. I still have short-term memory problems, but I can cope with them.

"I have stability in my life. I'm not in limbo-land any longer."

Doctors have known for 50 years that suppressing the immune system can slow the progression of MS, but the tradeoff could be fatal. Without a working immune system the body has nothing to fend off deadly bacteria or viruses.

The stem cell procedure has an unacceptable mortality rate—between 5 and 10 percent. But the rate in healthier patients has yet to be determined.

"It's in those people we want to reset the equilibrium," Burt said.

And Justin Sears, for one, couldn't agree more.

"The doctors told me not to count on the transplant reversing the disease," he said. "But I'm really glad I did it. So far, I love it. I absolutely love it."

Stem cells reproduce immune systems

Researchers at Northwestern Memorial extracted stem cells from the blood of multiple sclerosis patients, then used those cells to restore the patients' immune systems.

EXTRACTING THE STEM CELLS

A patient is given drugs to force **hematopoietic stem cells** (those which produce new blood cells) from the bone marrow into the bloodstream.

- The stem cells are separated from other components of the blood and frozen.

PREPARING THE MARROW FOR NEW CELLS

The patient receives a week of **chemotherapy and radiation therapy** to destroy the bone marrow that is producing the harmful immune system. In multiple sclerosis, the immune system attacks the patient's body.

RETURNING THE STEM CELLS

The stem cells are re-infused into the patient's bloodstream, then migrate into the bone marrow where they produce cells that can make up a new immune system.

STEM CELLS RESTORE THE IMMUNE SYSTEM

If the therapy is successful, within about two weeks, the stem cells produce two kinds of **white blood cells**:

- **B cells:** These become plasma cells and secrete antibodies into the bloodstream.
- **T cells:** These cells kill invading germs in the body.

The stem cells gradually produce the remaining components of the blood system necessary to restore the patient's immune system:

- **Red blood cells:** Their primary function is to carry oxygen throughout the body.
- **Platelets:** The primary role of these cells is to clot blood.

