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Umbilical Cord Blood: The Future of Stem Cell Research?

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Researchers at the University of Minnesota recently announced that they were able to largely reverse the effects of stroke in lab rats using stem cells found in human umbilical cord blood.

In the experiment, conducted by neurologist Walter Low and his colleagues, the transplanted stem cells took on properties of brain cells and seemed to spur the rats' brains to "rewire" themselves.

The researchers almost fully healed the rats 48 hours after the animals sustained brain damage. Typically doctors need to act within three hours to treat a human stroke patient successfully.

Cord-blood cell transplants are already becoming common as a therapy for diseases of the blood.

Now scientists like Low are finding that stem cells from umbilical cord blood—once thought capable only of turning into blood cells—may be able to grow into other kinds of cells as well.

Such advances are casting cord blood, previously regarded as medical waste left after childbirth, in a new light.

But while experts are optimistic about the future of cord blood as a source for new stem cell therapies, they disagree about how this potentially life-saving resource should be handled.

An Appealing Source of Stem Cells

It's not clear yet whether the therapy Low's team used on rats will ever be safe or effective in humans.

But many people with other life-threatening conditions have been healed with this easily collected source of stem cells.

Today doctors use cord blood cells to treat about 70 diseases, mostly anemias or cancers of the blood, such as leukemias and lymphomas.

"[Cord blood stem cells] can be used to replace failed blood cells," explained Kristine Gebbie, a professor of nursing at Columbia University in New York.

Six thousand patients worldwide have been treated with cord blood stem cell transplants to date, though the U.S. Food and Drug Administration still considers the procedure experimental.

For the therapies, doctors typically obtain cord blood from the placentas of volunteer donors after they give birth. The blood is then banked with one of several public registries.

If the donor and patient aren't genetically similar enough, the patient's body will reject the transfusion. The result can be fatal.

"A war goes on [between donor and recipient cells], and you want the donor [cells] to win," said Mary Laughlin, an expert in cord blood transplantation on the faculty at Case Western Reserve University in Cleveland, Ohio.

But cord blood transplants are more forgiving than other procedures, like bone marrow transplants, if the donor isn't a perfect genetic match.

And as volunteer donor banks grow, patients are often able to find suitable cord blood donor matches months before they might identify an appropriate bone marrow donor.

The Center for Cord Blood in Minneapolis, Minnesota, the largest public donor bank in the United States, reports that the likelihood of finding a perfect match in its bank has doubled in the last four years.

The center's Web site states that more than 95 percent of patients searching its registry are able to find suitable matches today.

Some companies, however, are encouraging families to save their own cord blood rather than donate it.

Keep It in the Family?

Each year thousands of new parents arrange for their newborns' cord blood to be saved and cryogenically frozen by private cord-blood banking services.

Families pay cord-blood banks up to U.S. $1,700 to freeze the blood, plus an annual storage fee of around $125.

The child and his or her family will then have exclusive use of the cells if the need for a transplant should arise.

A child's own cord blood is guaranteed to be a perfect match for that child. This means there's theoretically no chance that the cells will be rejected after transplantation.

But in the case of some diseases, doctors consider it unwise to use a child's own cord blood cells for treatment, says Columbia University's Gebbie.

Gebbie chaired a panel that advised the U.S. federal government regarding cord-blood banking.

"The cells may already carry in them the seeds of the cancer that you are trying to treat [in the child]," she said.

In other words, in cases of some genetic diseases, including many leukemias, doctors fear they would end up transplanting cells that would later become cancerous if they used a patient's own cord blood for the procedure.

For this reason, most transplants using privately stored blood are performed on the donors' siblings, explains Morey Kraus.

Kraus is chief technology officer for ViaCell, a Cambridge, Massachusetts-based company that offers a private cord-blood banking service called ViaCord.

"There's a higher probability of finding a match in the family than in a registry," Kraus said.

Experts agree that the odds are better that a patient will have a successful transplant from a donor who's a sibling rather than someone who isn't related.

But neither the American Academy of Pediatrics nor the Leukemia and Lymphoma Society recommend that parents of healthy children should store their child's cord blood with private banks.

Gebbie agrees.

"Were I still in a child-bearing mode, or if my daughter during her two recent pregnancies had asked me [if she should bank her baby's cord blood], I would have said, No," she said.

"It's an ongoing cost that has very little promise of being useful or successful for your child."

Some medical studies, like a 1997 report from the *Journal of Pediatric Hematology/Oncology,* estimate that there's a 1-in-2,700 chance that a child will get a disease that's advisable to treat with the child's own blood.

The chance that a child will get a disease that's treatable with a sibling's cord blood is much more likely. ViaCord's Kraus says that chance is about 1 in 328.

But Laughlin, of Case Western Reserve University, says those numbers don't tell her much.

She estimates that a child has roughly a 1-in-100,000 chance of getting acute leukemia.

"Then 85 percent of those 1 in 100,000 are cured with chemotherapy," she said.

"They don't need a transplant. Childhood leukemia is very curable now just with chemotherapy. So that reduces 1 in 100,000 to 1 in 800,000."

Laughlin says the incidence of those diseases for which cord blood is typically used is too low to warrant private banking. But preliminary research on more common disorders, like Low's stroke studies in rats, has her looking toward the future.

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Laughlin is betting, for example, that diabetes will be treated one day by cord-blood transplants.

ViaCord's Kraus said, "There's a huge uncertainty out there about where stem cell technology will come from and what kinds of stem cells will be used to treat what were formerly considered incurable diseases."

Building the Public Infrastructure

Minnesota's Low says he would prefer parents donate cord blood to a central reserve that's available to everyone, strengthening existing public banks.

"To me, that makes more sense," he said. "You make sort of a national cord-blood bank that everyone can deposit into and everyone can draw from."

He's not the only one thinking this way.

In 2004 the U.S. federal government set aside money to establish a central system for cord blood banking, to be facilitated by the Department of Health and Human Services.

Last year President George W. Bush signed into law the Stem Cell Therapeutic and Research Act, which supports building a reserve of 150,000 cord blood units from ethnically diverse donors.

Gebbie is optimistic that an effective national system will be in place soon.

The biggest challenge, she says, is getting more units from minority groups.

Because of limited donor pools, minorities have had difficulty finding suitable matches.

Fixing that will require outreach and advertising to those communities. But, she said, "it's not a ten-year project."