

Stem cell lines created from discarded IVF embryos

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Human embryos that are discarded every day as medical waste from in vitro fertilization (IVF) clinics could be an important source of stem cells for research, according to a team of Harvard Stem Cell Institute researchers at Children's Hospital Boston.

Some of the embryos created during IVF are deemed "clinically useless" because of imperfections, but a paper published in the January 27 online edition of *Nature Biotechnology* shows that it is possible to derive stem cell lines from these poor-quality embryos. Paul Lerou, the study's first author and a neonatologist at Children's, said, "We have definitively shown that those embryos that can't be used clinically are a reliable source for embryonic stem cell derivation."

Because poor-quality embryos are discarded everyday in the course of IVF, the authors believe they represent an ethically acceptable source of stem cells for research. Typically, half of an average yield of seven embryos per cycle are discarded, providing a potential source of hundreds of thousands of embryos every year. "It's a resource that's out there that we feel should be used," Lerou said.

An embryonic stem cell line is a population of cells that can grow and divide indefinitely outside the body, providing a source of cells for scientists conducting stem cell research. However, these cultured cells begin to change over time, so scientists must create new lines in order to have an ongoing source of cells to study. Because human embryos are a limited resource, scientists have been trying to determine how far an

embryo must be developed in order to give rise to a cell line.

During the IVF process, specialists work to identify embryos most likely to yield a healthy baby. Once an egg is fertilized by sperm, the embryo is allowed to incubate for a few days before being implanted into a woman's uterus. During that time, the embryo--which contains just a few cells--is evaluated according to a grading system and some are discarded if they are poorly shaped or have failed to grow normally.

The current study sheds light on the feasibility of creating stem cell lines from IVF embryos at different stages of development and of different quality. The research team attempted to derive stem cell lines from more than 400 poor-quality embryos received from the IVF clinic at the Brigham and Women's Hospital. Lerou, who is also an instructor in pediatrics at Harvard Medical School, said that by using such a large sample, the team could statistically calculate how readily embryos at different stages of development gave rise to stem cell lines. They found that discarded embryos can yield viable stem cell lines, but the efficiency of creating lines depends on the stage of the embryo's development.

From a sample of 171 embryos that were discarded just three days after fertilization, the team was able to derive only one stem cell line, which came from an embryo that had ceased dividing. This represents the earliest embryo that had ever yielded a stem cell line. Most human embryonic stem cell lines are derived from embryos that have become blastocysts, usually at about five days after fertilization.

The findings suggest that even these "early-arrested" embryos, sometimes called dead embryos, may harbor individual cells capable of growing and dividing. Earlier reports about creating stem cell lines from early-arrested embryos garnered attention as a way for scientists to use cells from dead embryos in a manner akin to harvesting organs from a

person who is determined to be brain-dead, which might be deemed more ethically acceptable. However, the current study shows that the success rate using early-arrested embryos is a mere 0.6 percent, a number that is too inefficient to be practical for science, according to George Daley, a member of the HSCI Executive Committee, associate director of the Stem Cell Program at Children's Hospital Boston, and senior author of the study.

The ability to create stem cell lines from discarded embryos rose dramatically in embryos that were slightly more developed. Embryos discarded from the clinic at day five of their development gave rise to stem cell lines at a rate of 4.1 percent, while those that had reached the blastocyst stage by that point yielded stem cell lines with an 8.5 percent success rate. The authors point out that these efficiency rates are similar to that of normal frozen embryos. "Prior work had suggested that poor quality embryos would only rarely yield stem cell lines, but we have shown that blastocyst stage embryos are a robust source of stem cells," says George Daley, who is also an associate professor of Biological Chemistry and Molecular Pharmacology at Harvard Medical School.

Source: Harvard University

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