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New source of stem cells form heart muscle cells, repair damage

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A new and non-controversial source of stem cells can form heart muscle cells and help repair heart damage, according to results of preliminary lab tests reported in *Circulation Research: Journal of the American Heart Association.*

Investigators in Japan used the amniotic membrane — the inner lining of the sac in which an embryo develops — to obtain stem cells called human amniotic membrane-derived mesenchymal (undifferentiated) cells (hAMCs).

"The amniotic membrane is medical waste that could be collected and used after delivery," said Shunichiro Miyoshi, M.D., Ph.D., co-author of the study and assistant professor in the cardiology department and Institute for Advanced Cardiac Therapeutics at the Keio University School of Medicine in Tokyo.
In laboratory studies, the hAMCs:

- transformed into heart muscle cells, with 33 percent beating spontaneously.
- improved function of rat hearts 34 percent to 39 percent when injected two weeks after a heart attack, while untreated hearts continued to decline in function.
- decreased the scarred area of damaged rat hearts 13 percent to 18

percent when injected after a heart attack.

- survived for more than four weeks in the rat heart without being rejected by the recipient's immune system, even without immunosuppressive medication.

The ability of hAMCs to convert into heart muscle cells was far greater than that from mesenchymal cells derived from bone marrow or fat, Miyoshi said.

That the implanted cells were not rejected is likely because the amniotic sac is a barrier between a woman and her developing fetus. To help prevent either of their immune systems from attacking the other as foreign tissue, the amniotic membrane between them does not produce the proteins that immune systems use to identify foreign tissue. This means the usual tissue-type matching (HLA typing) needed prior to transplantation would not be needed if hAMCs were used. Drugs to suppress the immune system also might not be needed after transplant.

The findings also suggest that hAMCs can differentiate into cells of various organs.

"If we had to create a cell bank system to cover every HLA type, we would need to store a great amount of cells, many of which would never be used," Miyoshi said. "Because hAMCs do not require such a system, it would be less expensive and usable for all patients."

Much work remains to be done before testing hAMCs in humans, said the researchers, who are repeating their experiments in larger animals and working to boost the number of heart cells generated by the hAMCs.

The investigators "are to be congratulated for their careful work that has brought forward a cell type that may offer the real potential for off-the-

shelf cardiac myocyte [muscle cell]-based therapy," Marc S. Penn, M.D., Ph.D., and Maritza E. Mayorga, Ph.D., of the Cleveland Clinic, wrote in an editorial in Circulation Research.

Provided by American Heart Association