Dr. Piero Anversa

# Cardiac stem cell therapies show promise

## Leading researcher says treatments could reverse heart disease

Stem cell therapies that repair damage to the heart could be widely available in the near future, according to one of the world's leading researchers in the field.

Dr. Piero Anversa says there is a great deal of work going on in the field of cardiac stem cell research right now, with clinical trials of various therapies underway in Europe and the United States. Nonetheless, he says a lot of work remains to be done before such treatments become commonly available.

"There have been tremendous advances in the treatment of chronic heart failure," Anversa says. "However, what is being done is to essentially keep people living longer with chronic heart failure. What cell therapy is aiming to do is to reverse the process, and thereby improve the quality of life of the patient with chronic heart disease. I believe that stem cell therapy may have a chance to change the evolution of chronic heart failure."

When will new cardiac stem cell treatments be widely available? "We have to be patient,' says Anversa. "This is an experimental therapy. I hope it will take less than 10 years, but can I put a real number on it? No."

Anversa is Director of the Center for Regenerative Medicine at Brigham and Women's Hospital, Harvard Medical School in Boston. He was in Winnipeg earlier this month to speak at the Harold Buchwald Heart Health Luncheon.

The Italian-born scientist is one of the early pioneers of cardiac stem cell research, and is widely credited with changing the way people think about the heart and heart disease.

Stem cells are undifferentiated cells that emerge early in life and serve as building blocks for the human body and all its organs and tissue. As a result, scientists say that stem cells have the potential to repair organs or

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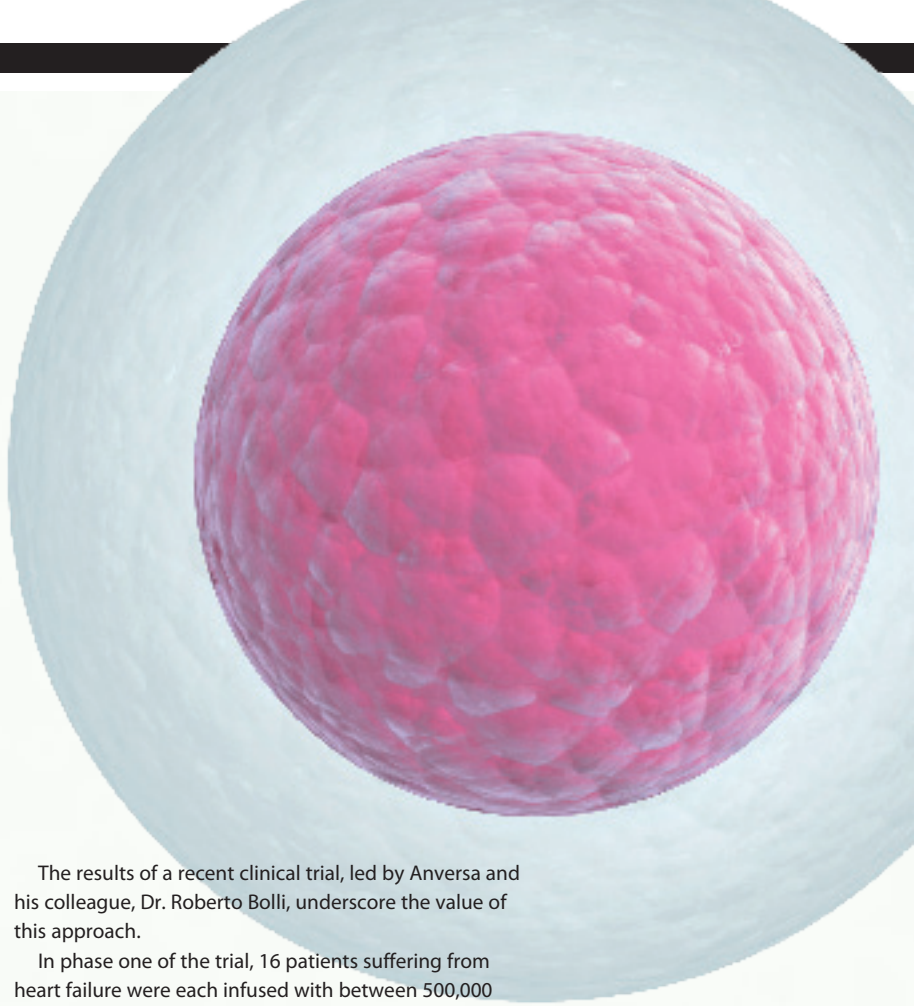

tissue damaged through illness or trauma.

Although research in this field is still in its early stages, stem cells are currently used to treat a limited number of illnesses. A bone marrow transplant, for example, essentially involves the transfer of haematopoietic (blood) stem cells from a donor to a recipient. The transplanted stem cells then regenerate the recipient patient's bone marrow.

Anversa's first major breakthrough came in 2001. At the time, conventional wisdom held that heart muscle, once damaged, could not be revived. Anversa showed this was not the case. Using a mouse model, he was able to demonstrate that hematopoietic stem cells were capable of developing into tissue that could repair damage to the heart.

"We were able to show that hematopoietic stem cells possessed significant plasticity, and we were able to show that (the cells) are capable of forming cardiomyocytes (heart muscle) in a mouse model," he says.

Since then, other scientists have pursued the idea of using hematopoietic stem cells to create cardiomyocytes. A clinical trial now underway in Europe has enrolled 3,000 patients to test the effectiveness of this approach in treating heart disease.

Anversa, meanwhile, is focusing his work on the effectiveness of stem cells derived straight from the heart as opposed to hematopoietic stem cells.

Over the years, he has demonstrated that cardiac stem cells are capable of forming cardiomyocytes (heart muscle cells), endothelial cells (coronary vessel cells) and fibroblasts (cells found in connective tissue).

The results of a recent clinical trial, led by Anversa and his colleague, Dr. Roberto Bolli, underscore the value of this approach.

In phase one of the trial, 16 patients suffering from heart failure were each infused with between 500,000 and one million cardiac stem cells. In 12 of 14 patients, the left ventricular ejection fraction (the heart's ability to pump blood) jumped from 30.3 per cent to 38.5 per cent after four months. For eight of the patients, the LVEF jumped to 42.5 per cent after one year. None of the patients suffered adverse effects from the treatment.

"Our clinical trial is going very well," says Anversa. "However, it is phase one. We are now trying to obtain the funds for a phase two clinical trial."

Anversa's work involves several steps. First, he harvests stem cells from a human heart, usually through a biopsy. Once in the lab, he manipulates the cells to make them grow to a clinically relevant number. The cells are then reintroduced to the damaged heart of a patient through a process called coronary infusion. The reintroduced cells then regenerate the heart's damaged cells.

Looking forward, Anversa hopes to answer two key questions as he continues his research: 1) How many cardiac stem cells should be used in the infusion process? 2) Is it possible to develop a more potent line of cardiac stem cells?

"Our search right now is for a cell that is more powerful, to see whether we can identify a subset of this cardiac stem cell that we have used… to see if it can be more effective in the treatment of chronic heart failure."