Five big strides to fight lung disease in our tiniest patients

December 4 2012

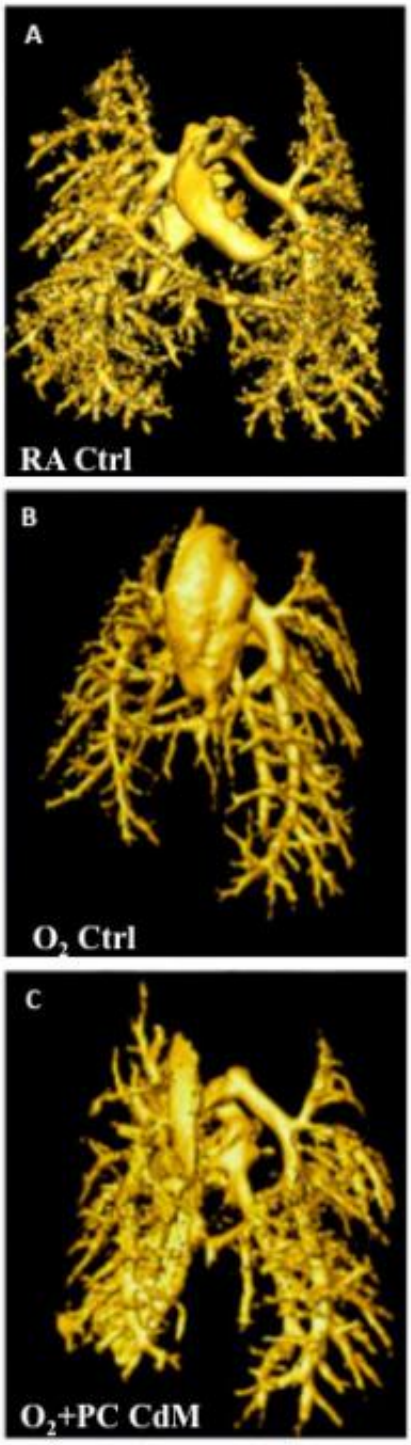
For Ottawa scientist and neonatologist Dr. Bernard Thébaud, even a major paper that answers five significant questions still doesn't seem quite enough in his determined path to get his laboratory breakthrough into the neonatal intensive care unit (NICU). Dr. Thébaud's proposed therapy would use stem cells from umbilical cords to treat a disease previously thought to be untreatable—bronchopulmonary dysplasia, or BPD.

"BPD is a lung disease described 45 years ago in which we have made zero progress. And now, with these cord-derived stem cells there is a true potential for a major breakthrough," says Dr. Thébaud, a senior scientist at the Ottawa Hospital Research Institute and CHEO Research Institute, a neonatologist at CHEO and The Ottawa Hospital, and a professor in the Faculty of Medicine at the University of Ottawa.

"I am confident that we have the talent and the tools here at CHEO and OHRI to find a treatment for BPD. These findings published today are helping us get there," continues Thébaud.

BPD affects approximately 10,000 very premature newborns in Canada and the U.S. every year. The lungs of these infants are not developed enough to sustain them, so they must receive oxygen through a breathing machine. However, this combination of mechanical ventilation and oxygen damages the lungs and stops their development. In addition, longer stays in the NICU for these extremely premature babies affect the normal development of other parts of the body, including the retina, the

kidneys and the brain.



These are micro-tomography scans of blood vessels in the lung. Image A shows a normal lung. Image B shows the injury caused by oxygen. Image C shows a lung given oxygen and treated with stems cells from a human umbilical cord.

These are micro-tomography scans of blood vessels in the lung. Image A shows a normal lung. Image B shows the injury caused by oxygen. Image C shows a lung given oxygen and treated with stems cells from a human umbilical cord. Credit: Dr. Bernard Thébaud

Today in the journal *Thorax*, Dr. Thébaud's team provides significant findings in experiments with newborn rats given oxygen. The lung development of a newborn rat mimics that of a premature baby born at 24 weeks. The five major findings reported in *Thorax* are:

1. Stem cells called mesenchymal stromal cells (MSCs) from a human umbilical cord (not the blood) have a **protective effect** on the lungs when injected into the lungs as they were put on oxygen.
2. MSCs had a **reparative effect** when injected two weeks after being on oxygen.
3. When conditioned media—a cell-free substance produced by MSCs—was administered instead of MSCs, it was found to have the same protective and reparative effects as the stem cells.
4. When examined after six months (the equivalent of 40 human years), treated animals had better exercise performance and persistent benefit in lung structure.
5. MSCs did not adversely affect the long-term health of normal rats. One of the concerns about stem cells is that by promoting cell growth, they may cause cancerous growth. To address this question, Dr. Thébaud gave MSCs to a control group that was not treated with oxygen. When examined after six months, these animals were normal and healthy.

Within two years, Dr. Thébaud wants to be talking about a pilot study with 20 human patients showing that this stem-cell therapy is feasible and safe, and in four years he wants to embark on a randomized control trial. These are all steps in his profound desire to help the babies he sees in the NICU with BPD, and he is confident a treatment will be developed.

"It's going to happen here in Ottawa, but for babies worldwide," says Dr. Thébaud.

More information: The full article "Short, Long-term and Paracrine Effect of Human Umbilical Cord-derived Stem Cells in Lung Injury Prevention and Repair in Experimental BPD" was published online first by Thorax on December 4, 2012.

Provided by Ottawa Hospital Research Institute