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Commentary

Note on Stem Cell Therapy for Pulmonary Diseases

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DESCRIPTION

A team of analysts has developed a possible stem cell treatment for several lung conditions, such as Idiopathic Pulmonary Fibrosis (IPF), Chronic Obstructive Pulmonary Disease (COPD), and cystic fibrosis, often fatal conditions that affect tens and millions of Americans. The scientists demonstrated that they could collect lung stem cells from people using a relatively non-invasive, doctor's-office technique. They were then able to multiply the collected lung cells in the lab to yield enough cells sufficient for human therapy. In an another study, the team showed that in rats and mice they could use the same type of lung cell to successfully treat a model of IPF; a chronic, irreversible, and ultimately lethal disease characterized by a progressive decrease in lung function. This is the initial time that anyone has generated potentially therapeutic lung stem cells from minimally invasive biopsy specimens. They expected that the properties of these lung stem cells make them potentially therapeutic for a wide range of lung fibrosis disorders.

These diseases of the lung include the build-up of fibrous, scar-like tissue, typically due to chronic lung inflammation. As this fibrous tissue replaces lung tissue, the lungs become less effective to transfer oxygen to the blood. Patients ultimately are at risk of early death due to respiratory failure. In the case of Idiopathic Pulmonary Fibrosis (IPF), which has been linked to smoking, most patients live for less than five years after diagnosis? The two FDA-approved drug treatments for Idiopathic Pulmonary Fibrosis (IPF) decrease symptoms but do not prevent the underlying disease process. The only effective treatment is a lung transplantation, which carries a high mortality risk and involves the long-term use of immunosuppressive drugs.

Scientists have been investigating the alternative possibility of using stem cells to treat Idiopathic Pulmonary Fibrosis (IPF) and other lung fibrosis diseases. Stem cells are immature cells which can proliferate and turn into adult cells in order to repair injuries. Some types of stem cells have anti-inflammatory and anti-fibrotic properties which make them particularly attractive as potential treatments for fibrosis diseases.

Scientists have focused on a set of stem cells and support cells that reside in the lungs and can be reliably cultured from biopsied lung tissue. These cells are called lung spheroid cells for the distinctive sphere-like structures they form in culture. As the scientists reported, lung spheroid cells showed powerful regenerative properties when applied to a rat or mice of lung fibrosis. In their therapeutic activity, these cells also outperformed other non-lung derived stem cells known as mesenchymal stem cells, which are also under investigation to treat fibrosis. In the first of the two new studies, the team showed that they could obtain lung spheroid cells from human lung disease patients with a relatively non-invasive procedure called a trans-bronchial biopsy. They snipped tiny, seed-sized samples of airway tissue using a bronchoscope. This method involves far less risk to the patient than does a standard, chest-penetrating surgical biopsy of lung tissue.

Scientists also cultured lung spheroid cells from these tiny tissue samples until they were numerous enough in the tens of millions to be delivered therapeutically. When they infused the cells intravenously into mice, they found that most of the cells gathered in the animals' lungs. In the other study, the Scientists first induced a lung fibrosis condition in rats. The condition closely resembled human IPF. Then the Scientists injected the new cultured spheroid cells into one group of rats. Upon studying this group of animals and another group treated with a placebo, the Scientists saw healthier overall lung cells and significantly less lung inflammation and fibrosis in the rats treated with lung spheroid cells. Also, the treatment was safe and effective whether the lung spheroid cells were derived from the recipients' own lungs or from the lungs of an unrelated strain of rats. In other words, even if the donated stem cells were foreign, a harmful immune reaction in the recipient animals, as transplanted tissue normally does.

CONCLUSION

Scientists expected that when used therapeutically in humans, lung spheroid cells initially would be derived from the patient to minimize any immune-rejection risk. Ultimately, however, to obtain enough cells for widespread clinical use, doctors might

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collect them from healthy volunteers, as well as from whole lungs obtained from organ donation networks. The stem cells could later be used in patients or matched immunologically to recipients in much the same way transplanted organs are typically matched. A group of IPF patients and expect to apply later this year for FDA approval of the study. In the long run, the scientists hope their lung stem cell therapy will also help patients with other lung fibrosis conditions of which there are many, including COPD, cystic fibrosis, and fibro-cavernous pulmonary tuberculosis.