

Autologous Stem Cell Therapy & its Effects on COPD:

A Pilot Study

Jack Coleman Jr., M.D.

Introduction by the Lung Institute

The Problem with Chronic Pulmonary Diseases

Chronic Obstructive Pulmonary Disease (COPD) is a progressive lung disorder that occurs as a result of prolonged cigarette smoking, second-hand smoke, and polluted air or working conditions. COPD is the most prevalent form of chronic lung disease. The physiological symptoms of COPD include shortness of breath (dyspnea), cough, and sputum production, exercise intolerance and reduced Quality of Life (QOL). These signs and symptoms are brought about by chronic inflammation of the airways, which restricts breathing. When fibrotic tissues contract, the lumen is narrowed, compromising lung function. As histological studies confirm, airway fibrosis and luminal narrowing are major features that lead to airflow limitation in COPD¹⁻³.

Today, COPD is a serious global health issue, with a prevalence of 9-10% of adults aged 40 and older⁴. And the prevalence of the disease is only expected to rise. Currently COPD accounts for 27% of tobacco related deaths and is anticipated to become the fourth leading cause of death worldwide by 2030⁵. Today, COPD affects approximately 600 million individuals—roughly 5% of the world's population⁶. Despite modern medicine and technological advancements, there is no known cure for COPD.

The difficulty in treating COPD and other lung diseases rests in the trouble of stimulating alveolar wall formation¹⁵. Until recently, treatment has been limited by two things: a lack of understanding of the pathophysiology of these disease processes on a molecular level and a lack of pharmaceutical development that would affect these molecular mechanisms. This results in treatment focused primarily in addressing the symptoms of the disease rather than healing or slowing the progression of the disease itself.

The result is that there are few options available outside of bronchodilators and corticosteroids⁷. Although lung transplants are performed as an alternative option, there is currently a severe shortage of donor lungs, leaving many patients to die on waiting lists prior to transplantation. Lung transplantation is also a very invasive form of treatment, commonly offering poor results, a poor quality of life with a 5-year mortality rate of approximately 50%, and a litany of health problems associated with lifelong immunosuppression¹³.

However, it has been shown that undifferentiated multipotent endogenous tissue stem cells (cells that have been identified in nearly all tissues) may contribute to tissue maintenance and repair due to their inherent anti-inflammatory properties. Human mesenchymal stromal cells have been shown to produce large quantities of bioactive factors including cytokines and various growth factors which provide molecular cueing for regenerative pathways. This affects the status of responding cells intrinsic in the tissue¹⁸. These bioactive factors have the ability to influence multiple immune effector functions including cell development, maturation, and allo-reactive T-cell responses¹⁹. Although research on the use of autologous stem cells (both hematopoietic and mesenchymal) in regenerative stem cell therapy is still in the early stages of implementation, it has shown substantive progress in treating patients with few if any adverse effects.

Treatment Overview

Summary of Process

The Lung Institute (LI) provides treatment by harvesting autologous stem cells (hematopoietic stem cells and mesenchymal stromal cells) by withdrawing adipose tissue (fat), bone marrow or peripheral blood. These harvested cells are isolated and concentrated, and along with platelet-rich plasma, are then reintroduced into the body and enter the pulmonary vasculature (vessels of the lungs) where cells are trapped in the microcirculation (the “pulmonary trap”). Alternatively, nebulized stem cells are reintroduced through the airways in patients who have undergone an adipose (fat tissue) treatment.

Methodology

Individuals diagnosed with COPD were tracked by the Lung Institute to measure the effects of treatment via either the venous protocol or adipose protocol on both their pulmonary function as well as their Quality of Life.

Pulmonary Function Test (PFT)

All PFTs were performed according to national practice guideline standards for repeatability and acceptability⁸⁻¹⁰. On PFTs, pre-treatment data was collected through on-site testing or through previous medical examinations by the patient's primary physician (if done within two weeks). The test was then repeated by their primary physician 6 months after treatment.*

*Due to the examination information required from primary physicians, only 25 out of 100 patients are reflected in the PFT data.

Quality of Life Survey (QLS) and Quality Improvement Score (QIS)

Patients with progressive COPD will typically experience a steady decrease in their Quality of Life. Given this development, a patient's Quality of Life score is frequently used to define additional therapeutic effects, with regulatory authorities frequently encouraging their use as primary or secondary outcomes¹⁷.

On quality of life testing, data was collected through the implementation of the Clinical COPD Questionnaire (CCQ) based survey¹⁷. The survey measured the patient's self-assessed quality of life on a 0-6 scale, with adverse Quality of Life correlated in ascending numerical order. It was implemented in three stages: pre-treatment, 3-months post-treatment, and 6-months post-treatment. The survey measured two distinct outcomes: the QLS score, which measured the patient's self-assessed quality of life score, and the QIS, a percentage-based measurement determining the proportion of patients within the sample that experienced QLS score improvements.

Demographics

Over the duration of six months, the results of 100 patients treated for COPD through venous and adipose based therapies were tracked by the Lung Institute in order to measure changes in pulmonary function and any improvement in Quality of Life.

Of the 100 patients treated by the Lung Institute, 64 were male (64%) and 36 were female (36%). Ages of those treated range from 55-88 years old with an average age of 71. Throughout the study, 82 (82%) were treated with venous derived stem cells, while 18 (18%) were treated from stem cells derived from adipose tissue.

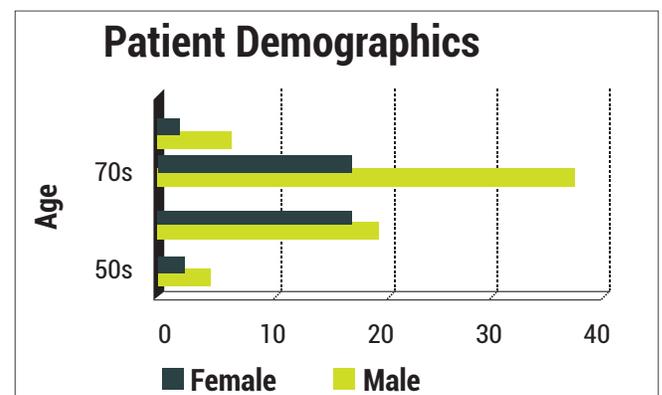


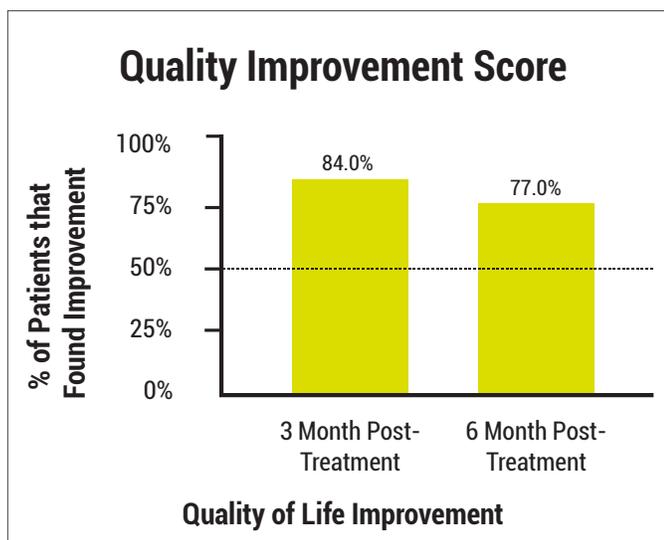
Figure 1.1 - Patient Demographics

Results

Chronic Obstructive Pulmonary Disease (COPD) Patients			
Quality of Life Survey (QLS)	Average Score*	Data Size	% Improvement
Pre-Treatment	3.8	100	-
3 Month Post-Treatment	2.5	100	35.5%
6 Month Post-Treatment	2.6	100	32.0%
Pulmonary Function Test (PFT) Results Sample Size: 25 Patients		Percentage %	
Average PFT Improvement		16.0%	
PFT Change >10%		48.0%	

Figure 1.2 - Lung Institute Outcomes Data

*The survey measured the patient's self-assessed quality of life on a 0-6 scale, with adverse Quality of Life correlated in ascending numerical order.



Over the course of the study, the patient group averaged an increase of 35.5% to their Quality of Life (QLS) score within three months of treatment. While in the QIS, 84% of all patients found that their Quality of Life score had improved within three months of treatment (figure 1.3).

Within the PFT results, 48% of patients tested saw an increase of over 10% to their original pulmonary function with an average increase of 16%. During the three to six month period after treatment, patients saw a small decline in their progress, with QLS scores dropping from 35% to 32%, and the QIS from 84% to 77%.

Figure 1.3 - Quality Improvement Score (QIS)

Fletcher and Peto's work shows that patient survival rate can be improved through appropriate or positive intervention¹⁴ (figure 1.4). It remains to be seen if better quality of life will translate to longevity, but if one examines what factors allow for improved quality of life such as improvement in oxygen use, exercise tolerance, medication use, visits to the hospital and reduction in disease flare ups then one can see that quality of life improves in association with clinical improvement.

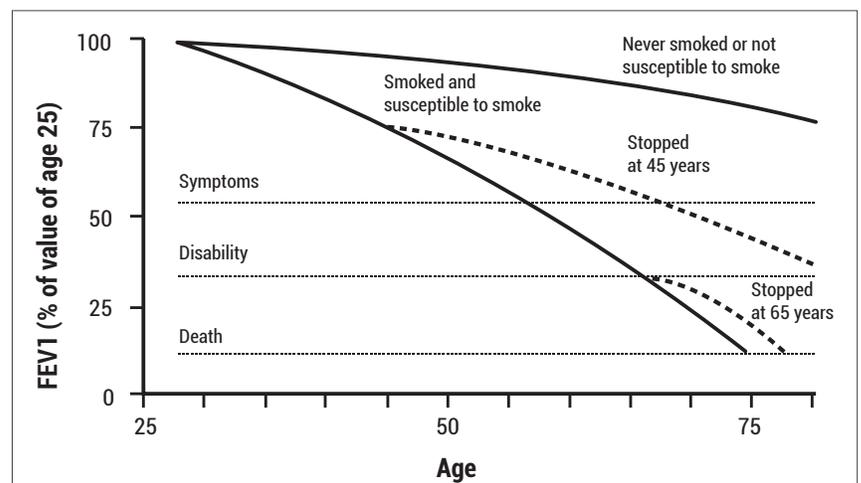


Figure 1.4 - Fletcher and Peto's 'Lung Function decline in COPD

Analysis

Currently the most utilized options for treating COPD are bronchodilator inhalers with or without corticosteroids and lung transplant – each has downsides. Inhalers are often used incorrectly¹¹, are expensive over time, and can only provide temporary relief of symptoms. Corticosteroids, though useful, have risk of serious adverse side effects such as infections, blood sugar imbalance, and weight gain to name a few¹⁶. Lung transplants are expensive, have an adverse impact on quality of life and have a high probability of rejection by the body the treatment of which creates a new set of problems for patients. In contrast, initial studies of stem cells treatments show efficacy, lack of adverse side effects and may be used safely in conjunction with other treatments.

Conclusion

Through the data collected by the Lung Institute, developing methodologies for this form of treatment are quickly taking place as other entities of the medical community follow suit. In a recent study of regenerative stem cell therapy done by the University of Utah, patients exhibited improvement in PFTs and oxygen requirement compared to the control group with no acute adverse events¹². Through the infusion of stem cells derived from the patient's own body, stem cell therapy minimizes the chance of rejection to the highest degree, promotes healing and can improve the patient's pulmonary function and quality of life with no adverse side effects.

Although more studies using a greater number of patients is needed to further examine objective parameters such as PFTs, exercise tests, oxygen, medication use and hospital visits, larger sample sizes will also help determine if one protocol is more beneficial than others. With deeper research, utilizing economic analysis along with longer-term follow up will answer questions on patient selection, the benefits of repeated treatments, and a possible reduction in healthcare costs for COPD treatment.

The field of Cellular Therapy and Regenerative Medicine is rapidly advancing and providing effective treatments for diseases in many areas of medicine.

The Lung Institutes strives to provide the latest in safe, effective therapy for chronic lung disease and maintain a leadership role in the clinical application of these technologies.

In a landscape of scarce options and rising costs, the Lung Institute believes that stem cell therapy is the future of treatment for those suffering from COPD and other lung diseases. Although data is limited at this stage, we are proud to champion this form of treatment while sharing our findings.

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