

Fast Physical Isolation of Stromal Vascular Fraction (SVF) as a Potential Therapy in Combating COVID-19 Induced Pulmonary Fibrosis

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ABSTRACT

The adipose-derived MSCs and Stromal Vascular Fraction (SVF) have been used for many years in autologous regenerative therapies with safe and satisfactory results. The potential use of MSCs, ASCs and related SVF in COVID-19 has been explored extensively due to regeneration and Immunomodulatory effect. The SVF is considered to be an attractive source of stem cells in cell therapy. Besides stem cells, it also contains other functional cells such as macrophages, precursor cells and pericytes. The rationale of the present work is to suggest the possibility to use fast physical sonication method for isolation of autologous SVF with the beneficial characteristics of fast, safe and minimal manipulation. It takes only one hour to complete whole procedures of cell isolation without using enzymes and incubation. Seventy seven years old female, non-smoker with chronic bronchitis for 20 years with pulmonary fibrosis cure using fast physical isolation autologous SVF cells. This treatment is safe with no side effects. It may represent the SVF as a potential therapy in combating COVID-19 induced pulmonary fibrosis.

Keywords: Pulmonary fibrosis; Chronic lung disease; Chronic asthma; Stromal vascular fraction; Stem cells

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INTRODUCTION

The adipose-derived MSCs and related SVF have been routinely used for many years in autologous regenerative therapies including immune-mediated inflammatory diseases (graft-versus-host disease and systemic lupus erythematosus),^[1] in lower extremity ulcers,^[2] breast reconstruction,^[3,4] outcomes of burns and scars with safe and

satisfactory results.^[5] The potential use of MSCs, ASCs and related SVF in COVID-19 have been explored extensively including both pre-clinical and clinical studies,^[6,7] suggesting their safety and efficacy.

To rapid application of adipose-derived MSCs and related SVF needs to utilize minimal manipulation procedure based on fat mechanical centrifugation and/or filtration in combination of the use of enzymatic digestion on collagenases.^[8,9,10] Otherwise, there will be a potential allogeneic use via a specific Human Tissue Fat Bio-Bank or via GTP laboratory, however, which needs big investment in advance. To compare the pros and cons between autologous and allogenic cell sources, minimal manipulation method seems to be more preference.

The rationale of the present work is to suggest the possibility to use fast physical sonication method for isolation of autologous SVF. The beneficial characteristics of the sonication method are fast, safe and minimal manipulation. It takes only one hour to complete whole procedures of cell isolation without using enzymes and incubation. All the procedures could be launched in a Biological Safety Cabinet (BSC) in operation room.

CASE PRESENTATION

Seventy seven years old female, non-smoker with chronic bronchitis for 20 years had been suffering from a chronic dry and stifling cough and significant decrease in her quality of life. Her lung functions were also objectively monitored by spirometry on a regular basis. She received bronchodilator drugs including inhaled corticosteroids and beta-mimetics intermittent. Chest X-ray demonstrated the chronic lung fibrosis. Due to constant deterioration of health, the patient received autologous SVF cell therapy through Bestem® cell processing platform during one surgical procedure. The Bestem® cell processing platform was used to isolate autologous SVF from subcutaneous fat tissue of abdominal wall. The physical isolation method is based on the ultrasonic cell recovery unit (StroMed®, Cell Innovations, Australia) for isolation under aseptic conditions.^[11] After the SVF stem cells preparation, she underwent autologous intravenous SVF cell therapy using 1.5×10^6 /kg of her body weight of autologous SVF cells with viability 92% isolated from 200 ml of adipose tissue.

One month after the SVF therapy, she was able to reduce her standard beta-mimetic medication, and her symptoms showed much improvement like chronic cough recovery. She was constantly improving further. She was found white hair turning black 3 months after SVF cell therapy. At 12 months after SVF cell therapy, her dry cough completely stop. Clinically, the patient felt very good and without a need for anti-fibrotic or anti-asthmatic medications. No respiratory tract infection was documented during the 24 months period since SVF cell therapy.

DISCUSSION

The coronavirus disease (COVID-19) has been threatening the global human health and life since the end of November 2019. The disease health care was still difficult without guidelines on definitive usage of pharmaceutical agents or vaccines. The patients of COVID-19 have reported complications, such as cytokine storms, when infected

with the virus. As the number of positive cases and the death across the globe is continuing, many researchers have turned to cell based therapy to combat COVID-19. The field of stem cells and regenerative medicine has provided immunomodulatory ability and repair, regenerate the native homeostasis of pulmonary parenchyma with improved pulmonary function.

The Stromal Vascular Fraction (SVF) is considered to be an attractive source of stem cells in cell therapy. Besides stem cells, it also contains other functional cells such as macrophages, precursor cells and pericytes. Pericytes^[12] are multi-functional mural cells that wrap around the endothelial cells that line the capillaries throughout the body.^[13] Pericytes communicate with endothelial cells by means of both direct physical contact and paracrine signaling.^[14] Pericytes also have stem cell function to be differentiated into mesenchymal stem cells to have regeneration and Immunomodulatory effect.

The collagenase digestion is the most frequently used method to isolate SVF, but it is time-consuming and has some problems, such as infectious agents and immune reactions. In our previous research, the ultrasonic cavitation method could effectively isolate SVF that required a relatively short time and had greater differentiation potential.

Here we document the pulmonary fibrosis cure using fast physical isolation autologous SVF cells. This treatment is safe with no side effects. It may represent the SVF as a potential therapy in combating COVID-19 induced pulmonary fibrosis. Definitely, large multicenter randomized trials should be performed to further evaluate the efficacy of SVF cells as a treatment for COVID-19 lung disease.

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