Quantification of Airway Collagen I Remodeling in Asthma

Soheil Hajimohammadi1,2, Jari Ullah3, Furquan Shaheen1, Tillie-Louise Hackett4
1Department of Heart Lung Innovation, UBC and St. Paul’s Hospital, Vancouver, BC, CANADA
2Department of Biomedical Engineering, The University of British Columbia, Vancouver, BC, CANADA
3Department of Biomedical Engineering, UBC, Vancouver, BC, CANADA
4Department of Anesthesiology, Pharmacology and Therapeutics, The University of British Columbia, Vancouver, BC, CANADA

Abstract

Introduction

Asthma is a chronic inflammatory disease of the airways. The disease normally appears as airway hyperresponsiveness and inflammation and is often characterized by pathological modification of the airway structure. The structural changes are termed airway remodeling and include: epithelial and subepithelial basement membrane thickening, remodeling of airway smooth muscle, and deposition of abnormal extracellular matrix components in the basement membrane. In particular collagen.

Methods

Masson’s Trichrome stained sections of human airways were used to evaluate the basement membrane thickness. Multi-photon excitation (MPE) microscopy was used to investigate the collagen structure. SHG microscopy was used to investigate the organization of the fibrillar collagen. The structural orientation of the fibrillar collagen was computed using a structure tensor analysis.

Results

In asthmatic patients, basement membrane thickness is thicker compared to non-asthmatic patients. In addition, the structural orientation of the fibrillar collagen is disorganized in asthmatic airways.

Conclusion

Our study demonstrates that asthmatic airways have significantly less organized collagen fibers compared to non-asthmatic airways. The structural orientation of the fibrillar collagen is more variable in asthmatic airways compared to non-asthmatic airways. This suggests that collagen remodeling in asthma plays an essential role in the pathogenesis of asthma.

Analysis

Hypothesis

We hypothesize that the structural orientation of the fibrillar collagen fibers in the basement membrane will be different in non-asthmatic and asthmatic airways.

Specific Aim

To compare fibrillar collagen arrangement and basement membrane thickness variation in non-asthmatic and asthmatic airways and to determine how this alteration affects fibrillogenesis.

Samples

Gender (m/f) Average Age (yrs)

Asthma

7/3

20.8

Non-asthma

7/3

17.4

References