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Altered Sputum Microstructure as a Marker of Airway Obstruction in Cystic Fibrosis Patients GREGG DUNCAN, JAMES JUNG, NATALIE WEST, MICHAEL BOYLE, JUNG SOO SUK, JUSTIN HANES, Johns Hopkins University — In the lungs of cystic fibrosis (CF) patients, highly viscoelastic mucus remains stagnant in the lung leading to obstructed airways prone to recurrent infections. Bulk-fluid rheological measurement is primarily used to assess the pathological features of mucus. However, this approach is limited in detecting microscopic properties on the length scale of pathogens and immune cells. We have shown in prior work based on the transport of muco-inert nanoparticles (MIP) in CF sputum that patients can carry significantly different microstructural properties. In this study, we aimed to determine the factors leading to variations between patients in sputum microstructure and their clinical implications. The microrheological properties of CF sputum were measured using multi-particle tracking experiments of MIP. MIP were made by grafting polyethylene glycol onto the surface of polystyrene nanoparticles which prior work has shown prevents adhesion to CF sputum. Biochemical analyses show that sputum microstructure was significantly altered by elevated mucin and DNA content. Reduction in sputum pore size is characteristic of patients with obstructed airways as indicated by measured pulmonary function tests. Our microstructural read-out may serve as a novel biomarker for CF.

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