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**Title:** Quantitative analysis of pulmonary cysts and emphysema on computed tomography: Lymphangiomyomatosis, Birt-Hogg-Dubé syndrome and chronic obstructive lung disease

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**Body:** Rationale: The method of characterizing fractals has been successfully applied to pulmonary physiology. Mishima and colleagues analyzed the number and size of low attenuation area (LAAs) in patients with COPD and determined that LAAs on CT scans display fractal properties. However, there is no report that assessed the usefulness of the methods of characterizing fractals of LAAs to analyze the pathophysiology in cystic lung diseases. Objectives: To characterize the pulmonary cysts in patients with cystic lung diseases (i.e. Lymphangiomyoma [LAM] and Birt-Hogg-Dubé syndrome [BHDS]) and emphysema in patients with COPD by quantification of LAAs on CT and to assess the usefulness of the methods of characterizing fractals of LAAs to analyze the pathophysiology in these diseases. Methods: This study included 52 LAM patients, 18 BHDS patients and 40 COPD patients. The number and size of discrete continuous low attenuation areas (CLA) on CT were quantitatively assessed by computer software, and then the fractal properties of LAAs were evaluated in these diseases. Results: The characteristics of LAAs differed between these diseases, and the fractal properties of CLA varied with a value of LAA% in LAM (0.963-0.973) and BHDS (0.849-0.998), but in COPD (0.982-0.996). By comparing these results, the way of the development of LAAs in these diseases were suggested. Conclusion: The computer-assisted, quantitative analysis of LAAs on CT images is useful to elucidate the pathogenesis of cystic lung diseases including LAM, BHDS, and COPD.