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Reopening of a microfluidic airway tree in the presence of liquid plugs YU SONG, MICHAEL BAUDOIN, PAUL MANNEVILLE, CHARLES BAROUD, LadHyX, Ecole Polytechnique, France — Many respiratory diseases are associated with the occlusion of pulmonary airways with liquid plugs, which are generally assumed to cause the collapse of the airways. Previous work has shown that the reopening of the airways proceeds through avalanches occurring over several generations, although measurements on real lungs are limited to single point measurements at the trachea. Here, we present a microfluidic model airway tree which consists of five generations of bifurcations that are partially occluded with liquid plugs. The initial distribution of the plugs in the tree displays high sensitivity to initial conditions with evidence of chaotic distribution. The reopening is achieved by applying a constant pressure or constant flow rate at the root of the tree and cascades of different types are observed in the two cases: While the constant pressure forcing is found to open the whole tree, a constant flow rate forcing opens only a single path. Finally we observe that the elasticity of the airways is not a necessary ingredient for the cascades to occur.

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