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Index-matched measurements of the effect of cartilaginous rings on tracheobronchial flow

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Index-matched measurements of the effect of cartilaginous rings on tracheobronchial flow

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Effects of cartilage rings on tracheobronchial flow.

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Abstract

We present a comparison of the flow characteristics in an idealized smooth trachea model and a second model which has a roughness simulating cartilaginous rings. We use refractive index-matched particle image velocimetry (PIV) to measure the velocity field in a two-generation model of the trachea and main bronchi. The flow rate has a trachea-based Reynolds number $Re=2800$, which is comparable to a level of light activity. Our results show considerable differences between both cases, the most important of which is the size and magnitude of recirculation zones at the inlet of both bronchi. The smooth case shows a larger separation bubble at the bronchi entrance, which may retain aerosols and have different effects on particles of different size. Furthermore, the smooth case displays a higher vorticity along the bottom walls of the bronchi, while a higher vorticity is seen along the trachea walls in the 'ringed' model.

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