SORS: Assessment of Form and Function in the Large Airways

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Abstract: The overall objectives of the research are to investigate the geometry of the large airways and the influence this exerts on patterns of airflow and functional performance. Two specific regions are considered: the nasal (upper) airways and the segment of the lower airways from larynx to carina. The nasal airways present a highly complex geometry, displaying a large degree of inter and intra subject variability. The nasal airways not only perform essential air conditioning physiological functions (heat and water exchange and primary filtration) but also house the olfactory receptors. Here a major clinical interest is in relating morphology to physiological function with the aim of providing better information for clinical assessment. In the large airways, the interest of this investigation is tracheal malformations and their effect on flow limitation.

The research seeks first of all to gather the necessary data, which is presently lacking, and secondly to apply analysis to characterise the salient geometric features and their influence on flow and particle delivery. The tasks of characterising the features and modelling the effects of flow and particle deposition are primarily computational, although we have validated these models using rapid prototype physical models for experimental studies.

Currently our decision to intervene surgically and our methods of interpreting surgical outcomes rely on subjective measures. Computational Fluid Dynamics (CFD) techniques and geometrical analysis tools of medical imaging can provide quantitative outcome measures to guide our decisions and the means to quantify our results.

Topical drug administration into the nasal cavity has become a widely prescribed form of delivering medications such as intranasal steroids for the treatment of sinonasal inflammatory, allergic, and infectious disorders. Topical nasal medication targets