Annals of Biomedical Engineering, Vol. 47, No. 12, December 2019 (© 2019) p. 2355
https://doi.org/10.1007/s10439-019-02385-z

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Letter to the Editor

Response to the Letter to the Editor "Airflow Simulation in Pulmonary Conducting Airways" by M. Monjezi and H. Jamaati

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(*Received 2 October 2019; accepted 9 October 2019; published online 24 October 2019*)

Associate Editor Stefan M. Duma oversaw the review of this article.

To the Editor,

We thank Drs. Monjezi and Jamaati for their careful review[1] of our paper titled "Airflow Simulations in Infant, Child, and Adult Pulmonary Conducting Airways."[2] First, we acknowledge a typo in the equation for $R^n_{i,j}$ in first paragraph of page 501.[2] The second term on the right hand side of that equation should have been divided by $C_{i,j}$. The correct form is

$$R^n_{i,j} = \frac{dt}{dV_{\Gamma_{i,j}}}\left[\Delta P_{\Gamma_{i,j}} - \frac{V_{\Gamma_{i,j}}}{C_{i,j}}\right] \quad (1)$$

We note that Eq. (1) is derived directly from Eq. (5) in our paper,[2] which is presented correctly. We also note that we employed the correct Eq. (1), and not the one with the typo, for our simulation results.

Secondly, Drs. Monjezi and Jamaati highlight[1] our finding that approximately 10% of the total pressure drop (ΔP) of the lung occurs within our simulated conducting airways ΔP_{3D}, which they argue is in disagreement with the pressure relationship given by Pedley *et al.*[4] However, the expression presented by Pedley *et al.* only models the pressure gradient that results from viscous airflow and not across the entire lung. In contrast, the ΔP that we calculate[2] includes the combined pressure drop due to total viscous (R_{global}) and compliance (C_{global}) effects. Moreover, in agreement with Otis *et al.*,[3] we posit that the majority of energy loss is due to movement of the parenchyma and not due to viscous forces. Namely, by performing an order-of-magnitude analysis for the adult, where the pressure drop across the resistor is $\Delta P_R \approx R_{\text{global}}Q_{\text{mean}} \approx 1.75$ cmH_2O and the pressure drop across the capacitor is $\Delta P_C \approx \frac{TV}{C_{\text{global}}} \approx 8.47$ cmH_2O, we find that the pressure drop due solely to viscous losses (ΔP_R) is roughly 17% of the total pressure drop $\left(100\left[\frac{\Delta P_R}{\Delta P_R + \Delta P_C}\right]\right)$. Thus, we believe that our finding of ΔP_{3D} ~10% of ΔP is reasonable.

Finally, we note that the 3D model had on average 6–7 airway generations. The adult model spanned *up to* 11 generations along paths where we were able to resolve more generations based on image quality.[2]

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