Experimental and theoretical impact of hypertonic saline induction on exhaled nitric oxide

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Background

Experimental [Haccuria, 2014] and simulation [Karamaoun, 2016] results showed that exhaled nitric oxide (FENO) is affected by airway caliber.

Hypertonic saline induction (HSI) likely affects airway caliber by increasing the level of liquid secretion.

Consequently, HSI may also affect FENO value even in subjects without airway hyperresponsiveness.

Aim

To experimentally and theoretically assess the influence of HSI on FENO in healthy subjects without airways hyperreactivity.

Methods

Simulations

A detailed model of airway epithelium and NO transport is used [Karamaoun, 2016], featuring a liquid layer lining airway epithelium.

Experiments

In 14 healthy subjects (10F/4M, 28±8 y), we measured before and after 20 minutes of HSI:

- FENO
- FEV, as a marker of central airways caliber
- The phase III slope (S) of the single breath washout (SBWO) using gases with different diffusivities, helium (He) and sulfur hexafluoride (SF₆), as a marker of peripheral airway impairment

Results

Simulations

Experiments

Discussion

- HSI did not affect central airways whereas peripheral heterogeneities were increased along with a huge FENO decrease.
- Model simulations predicted that the occurrence of a liquid layer specifically in peripheral airways may decrease FENO to the same extent than experimental observations.

Conclusion

- Experiments confirmed model predictions that FENO, after HSI, reacted to specific peripheral alterations in healthy subjects.
- This highlights the potential role of FENO as a marker of peripheral airway calibre change.