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A Decrease in Maxillary Sinus Pressure, as Seen in Upper Airway Allergy or Infection, Results in an Increase in Upper Airway Nitric Oxide Levels

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Abstract:

The paranasal sinuses are connected to the nasal cavity via small osties. Ostial occlusion, caused by mucosal swelling, will result in a slowly increasing negative pressure inside the sinus cavity. In parallel, the oxygen content in the sinus will decrease, resulting in the development of relative hypoxia. Hypoxia is a powerful inducer of nitric oxide (NO) synthase, and inducible NO synthase has been shown to be present in considerable amounts in the upper airways, including the sinuses. The present study was designed to investigate whether a reduction in sinus pressure would affect upper airway NO production. Thirteen healthy volunteers were investigated. A pressure chamber was used to lower the ambient pressure to -4.9 kPa. NO was sampled from one nostril or via a drainage tube inserted into the maxillary sinus before, during and after the hypobaric exposure. When the pressure was decreased, NO levels increased from 256±15 to 316±19 ppb ($n=13$, $p<0.001$). The

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NO levels remained elevated (282 ± 21 ppb; $p < 0.05$) when measurements were repeated 20 min after leaving the chamber. The nasal airway resistance ($V_{2_{tot}}$) also increased as a result of the chamber session (from $16 \pm 2^\circ$ before to $21 \pm 3^\circ$ after; $p < 0.05$). An increase in NO levels was also found when the experiments were repeated with NO sampled directly from the maxillary sinus (225 ± 6 before and 265 ± 9 ppb after; $n = 6$, $p < 0.001$). For control purposes the nasal analyses were repeated again, this time under hyperbaric conditions (+4.9 kPa). This resulted in a slight decrease in the NO levels (from 273 ± 22 to 241 ± 17 ppb; $n = 10$, $p < 0.001$), but there was no change in the nasal airway resistance. We conclude that a reduction in sinus pressure, as seen in upper airway allergy or infection, may result in an increase in upper airway NO production.

Keywords:

Airway, Resistance, Allergy, Hyperbaric, Hypobaric, Maxillary, Sinus, Nasal, Mucosa, Nitric, Oxide, Nose, Pressure, Sinus, Nasal, Mucosa, Nitric, Oxide, Nose, Pressure

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