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Inhalation of hypertonic saline aerosol enhances mucociliary clearance in asthmatic and healthy subjects.

[Daviskas E](#)¹, [Anderson SD](#), [Gonda I](#), [Eberl S](#), [Meikle S](#), [Seale JP](#), [Bautovich G](#).

[Author information](#)

1 Dept of Respiratory Medicine, Royal Prince Alfred Hospital, Sydney, Australia.

Abstract

Hyperosmolarity of the airway surface liquid (ASL) has been proposed as the stimulus for hyperpnoea-induced asthma. We found previously that mucociliary clearance (MCC) was increased after isocapnic hyperventilation (ISH) with dry air, and we proposed that the increase related to transient hyperosmolarity of the ASL. We investigated the effect of increasing the osmolarity of the ASL on MCC, by administering an aerosol of concentrated salt solution. MCC was measured using 99mTc-sulphur colloid, gamma camera and computer analysis in 12 asthmatic and 10 healthy subjects on three separate days, involving administration of each of the following: 1) ultrasonically nebulized 14.4% saline; 2) ultrasonically nebulized 0.9% saline; and 3) no aerosol intervention (control). The (mean \pm SD) volume of nebulized 14.4% saline was 2.2 \pm 1.2 mL for asthmatics and 3.2 \pm 0.7 mL for healthy subjects. This volume was delivered over a period of 5.4 \pm 1.3 and 6.4 \pm 0.7 min for asthmatic and healthy subjects, respectively. The airway response to 14.4% saline was assessed on a separate visit and the fall in forced expiratory volume in one second (FEV1) was 22 \pm 4% in the asthmatic and 3 \pm 2% in the healthy subjects. Compared to the MCC with the 0.9% saline and control, the hypertonic aerosol increased MCC in both groups. In asthmatic subjects, MCC of the whole right lung in 1 h was 68 \pm 10% with 14.4% saline vs 44 \pm 14% with 0.9% saline and 39 \pm 13% with control. In healthy subjects, MCC of the whole right lung in 1 h was 53 \pm 12% with 14.4% saline vs 41 \pm 15% with 0.9% saline and 36 \pm 13% with control. We conclude that an increase in osmolarity of the airway surface liquid increases mucociliary clearance both in asthmatic and healthy subjects. These findings are in keeping with our previous suggestion that the increase in mucociliary clearance after isotonic hyperventilation with dry air is due to a transient hyperosmolarity of the airway surface liquid.

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