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ORIGINAL ARTICLE

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Correlation between nasal resistance and different acoustic rhinometry parameters in children and adolescents with and without allergic rhinitis

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Abstract

Acoustic rhinometry and rhinomanometry are important tests used to assess nasal function. The degree to which the parameters of these tests are correlated is yet to be established.

Objective: This paper aimed to study the correlations between nasal resistance (NR) and acoustic rhinometry parameters in children and adolescents with allergic rhinitis and controls.

Method: Twenty patients with allergic rhinitis and 20 controls were enrolled. NR, volumes (V4, V5, V2-5), and minimal cross-sectional areas (MC1, MC2) were measured in three moments: baseline, after induction of nasal obstruction and after topical decongestant administration.

Results: Patients with allergic rhinitis had significant correlation between NR and all volumes (V5: r = -0.60) and with MC2. Among controls, MC1 was the parameter with the strongest correlation with NR at baseline (r = -0.53) and after decongestant administration. In the combined analysis, V5 had the highest correlation coefficients at baseline (r = -0.53), after obstruction (r = -0.58) and after decongestant (r = -0.46).

Conclusions: Our data showed that NR and acoustic rhinometry parameters have negative and significant correlations. Nasal volumes are, in general, better correlated than minimal cross-sectional areas. V5 was the parameter with the highest correlation in the rhinitis group and in the combined analysis.

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INTRODUCTION

Rhinomanometry is one of the most widely studied, employed, and standardized tests used to assess nasal function. Dynamic measurements of the ratios between airflow and pressure levels in the nasal cavity can be obtained from rhinomanometry to compute nasal resistance[1]. It has been shown that nasal resistance (NR) is a reliable parameter to monitor the effect of drug therapy and follow nasal provocation tests[2].

Among the other available tests, acoustic rhinometry (AR) appears to hold significant promise. This is a relatively new test which allows one to assess nasal geometry using a device - the acoustic rhinometer - that emits and captures sound waves on the entrance of the nasal cavity to map its anatomy, measure volumes, and cross sectional areas at various points[3]. Studies have shown that AR is a reliable and reproducible method when it comes to measuring the nasal volumes of children and adults[4]. Due to its properties, AR has been used to study the definitions concerning surgery indications of patients with upper airway anatomic disturbances[5], to assess the effect of drugs used to treat allergic rhinitis[6] and to enhance the understanding of nasal physiology[7].

These two tests, however, measure variables of different natures. While rhinomanometry dynamically calculates a physiological variable (NR) connected to nasal breathing, AR statistically measures nasal cavity volumes and cross sectional areas. Both tests have been independently validated, but information available on the correlations between them is scarce. The extent to which one test can be correlated to the other, the AR parameters that can be compared against NR, and the possible variations between adults and children or even between patients with varying degrees of nasal obstruction are yet to be defined.

This study aimed to assess the correlations between NR and various parameters related to volumes and cross sectional areas measured using AR in children and adolescents with persistent allergic rhinitis and healthy controls.

METHOD

The patients

The allergic rhinitis group was made up of children and teens aged between six and 18 years followed up regularly at a specialized clinic. All subjects had been diagnosed with persistent allergic rhinitis for at least a year according to the ARIA[8] initiative precepts and positive skin allergy tests (mean papule diameter greater than 3 mm)[9] for at least one inhaled allergen (*D.pteronyssinus, D.farinae, Blomia tropicalis*, dog epithelium, cat epithelium, *Periplaneta americana, Blatella germanica*, mix of fungi, pollen mix [IPI-ASAC, Brazil]). Subjects with significant upper airway anatomic defects (deviated septum [anterior rhinoscopy] and enlarged adenoids [cavum x-ray]), individuals on systemic or nasal steroids for the past 30 days, and patients with history of upper airway infection within the last 30 days were excluded.

Children and adolescents within the same age range made up the control group. The subjects in this group had no history of rhinitis and other atopic diseases, did not present significant alteration in the nasal fossae on anterior rhinoscopy, and were negative for allergy for the same set of inhaled allergens used to test case group individuals.

Nasal function assessment

Two consecutive tests were used to evaluate nasal function. All tests were carried out with the subjects seated with their heads on a neutral position and after they had waited for 20 minutes to get used to the controlled room temperature (20°C to 25°C) and humidity (50%) conditions. AR was performed with an SRE 2000 acoustic rhinometer (Rhinometrics, Denmark) in accordance with published recommendations[1]. The following parameters were assessed: volume of the proximal portion of the nasal cavity from 0 to 4.0 cm (V4), between 0 and 5.0 cm (V5), of the segment between 2.0 and 5.0 cm (V2-5), and the smaller cross sectional area in the segments between 0 and 2.2 cm (MC1) and 2.2 and 5.4 cm (MC2). The size of each nostril was assessed and analyzed separately.

NR was measured through active anterior rhinomanometry (AAR) with the same device used to perform AR. NR (inhalation) was measured at 75 Pa by the same examiner three times. Only measurements with variation under 10% were accepted.

The parameters were captured at three different stages:

1. Baseline: after acclimation to the test room and before subjects were given medication.
2. Obstruction: after the completion of the nasal provocation testing, after an increase of at least 100% on baseline nasal resistance, after delivery of solutions with different levels of histamines (0.12; 0.25; 0.5; 1.0; 2.0; 4.0 & 8.0 mg/ml, IPI-ASAC Brazil).
3. Unobstructed: 10 minutes after giving topical decongestants to subjects (three drops of oxymetazoline [0.5mg/ml] on each nostril).

Assessments were carried out sequentially on the same day. The first was the baseline test, followed by the tests done after nasal obstruction had been induced, and lastly by the tests when nasal obstruction was no longer present (after delivery of decongestants).

The correlations between the variables were analyzed through Spearman's rank correlation ratio using software package SPSS 14.0. A significance level of 5% was defined to reject the null hypothesis.

This study was approved by the Research Ethics Committee at UNIFESP-EPM (permit nº 0705/04). Informed