Allergol Immunopathol (Madr). 2011;**39(6)**:342–346

Allergologia et immunopathologia

www.elsevier.es/ai

ORIGINAL ARTICLE

Active anterior rhinomanometry in paediatrics. Normality criteria

J.C. Juliá[a,*], M. Enriqueta Burchés[b], A. Martorell[c]

[a] *Centro de Salud de Alzira, Valencia, Spain*
[b] *Centro de Salud de Xirivella, Valencia, Spain*
[c] *Unidad de Alergologia, Consorcio Hospital General Universitario de Valencia, Valencia, Spain*

Received 9 June 2010; accepted 6 October 2010
Available online 25 February 2011

KEYWORDS
Children;
Nasal air flow;
Nasal provocation;
Pressure;
Resistance;
Rhinitis;
Rhinomanometry

Abstract
Background: Active anterior rhinomanometry with a face mask was used to establish the lower age limit for application of the technique, define normality reference standards, and determine the most appropriate pressure for referencing the nasal resistance values.
Material and methods: A total of 409 children of both sexes and aged 5-14 years were studied. The subjects were selected from among healthy children in two primary care centres and one school. The Rhinospir 164 rhinomanometer was used for the tests. Rhinomanometry was performed according to the guidelines of the International Committee on Standardization of Rhinomanometry. The SPSS (Statistical Package for the Social Sciences) was used for the analysis of the results.
Results: The study sample was divided into five age groups involving intervals of two years from 5 to 14 years of age, and four body surface groups. The dependent variables studied (resistances and flows at pressure differences of 75 and 100) showed significantly different mean values according to age and body surface. All the mean ratios were over 1.4 units, i.e., the measures of each variable on one side and the other differed between 40% and 44%.
Conclusions: 1.- The lower age limit for rhinomanometry is five years. 2.- The most appropriate pressures for referencing the resistance and flow values are 75 and 100. 3.- The reference standards are established with respect to total resistance and according to subject age and body surface.

Introduction

In routine clinical practice it is very complicated to quantify the subjective sensation caused by nasal obstruction. In order to establish a quantitative measure, the determination of nasal air flow resistance can be taken to reflect nasal obstruction. On the other hand, the perception of nasal obstruction varies considerably, and it has not been possible to establish a direct correlation to real nasal air flow resistance.[1] Rhinomanometers have been designed and used in this context.

Rhinomanometry measures the difference in transnasal pressure of the air flow through the nasal cavity. In order to physiologically determine nasal air flow resistance, it is

* Corresponding author.
E-mail address: juancarlosjulia@hotmail.com (J.C. Juliá).

0301-0546/$ – see front matter © 2010 SEICAP. Published by Elsevier España, S.L. All rights reserved.
doi:10.1016/j.aller.2010.10.004

necessary to simultaneously measure the pressure gradient and air flow through the nose. The resistance is obtained from these measures by simply dividing pressure gradient by air flow.[2]

Nasal respiratory function can be measured in an active and dynamic manner while the patient is breathing, or in a passive or static manner by applying a flow at a given pressure through the nasal passages while the patient is in apnoea. The relationships between nasal pressure and flow presently can be measured by anterior, posterior and forced oscillation rhinomanometry. Anterior rhinomanometry may be active or passive, while posterior rhinomanometry is active.

In active anterior rhinomanometry, the air flow and pressure gradients are measured through the right and left nostril during a normal respiratory cycle.

In a consensus document, the International Committee on Standardization of Rhinomanometry established that the most physiological rhinomanometrical technique is active anterior rhinomanometry,[3–5] defining this as the method of choice for measuring nasal ventilation.

The main advantages of active anterior rhinomanometry are that it is easy and relatively rapid to perform, requires scant patient cooperation, and is well tolerated.

Rhinomanometry is not routinely used in normal clinical practice in children for the study of rhinitis, mainly because of the variability of the technique, the lack of normality reference values, and the time required to perform the technique. Nevertheless, it is very useful for observing the seasonal variability in symptoms and their allergenic correlations,[6] and for studying the presence of nasal hyperresponsiveness.[7–9] On the other hand, it is an objective tool for evaluating different intranasal treatments,[10,11] and for the follow-up of nasal provocation testing with allergic response mediators,[12,13] allergens[14] and other substances (methacholine, histamine).[15,16] In addition, the measurement of unilateral nasal resistance allows the study of anatomical obstructions and offers objective data on the efficacy of corrective surgery.

Two Japanese studies predating our own work suggested a decrease in nasal resistance in groups of schoolchildren and students in relation to age,[17,18] and only one study in Caucasians has reported nasal airflow values at a pressure of 150 Pa based on active anterior rhinometry in a large group of healthy children and adolescents. In this case the regression equations were calculated in relation to subject height and age.

Since not all children are able to reach a pressure of 150 Pa, further studies are needed to reference nasal airflow values to other lesser pressures. For these reasons we have measured the nasal airflow and nasal airflow resistance values at a pressure of 75 and 100 Pa during inspiration by active anterior rhinometry in a large group of healthy children. From the data obtained, we calculated the regression equations at pressures and resistances of 75 and 100 Pa pressure difference (TEF-75, TEF-100, TER-75 and TER-100) according to body surface and age.

The present study employs active anterior rhinomanometry using a face mask, with the following objectives:

1. To establish the lower age limit for application of the rhinomanometry technique.
2. To establish a normality reference standard.
3. To assess the most appropriate pressure for referencing the nasal resistance values.
4. To study total resistance and the relationship between both nasal fossae.

Material and methods

Material

We studied a total of 409 children, 220 girls (53.8%) and 189 boys (46.2%), aged between 5 and 14 years.

The subjects were selected from among healthy children in two primary care centres (Centro de Salud Fuensanta in Valencia, and Centro de Salud Paterna) and in one school of the province of Valencia, Spain (Colegio Público Sagrado Corazón, in Alginet).

Voluntary collaboration was requested from the parents, after explaining the characteristics of the study and its non-invasive nature.

Method

Instruments

The study was carried out using the Rhinospir 164 computerised rhinomanometer with a face mask.

For sealing of the nostril we used nasal adhesive adaptable to any nasal anatomy, and perforated in the centre to allow communication between the interior of the nasal fossa and the rhinomanometer.[15]

Study inclusion criteria

The children were considered healthy on the basis of the findings of a personalised interview and the results of external nasal examination and anterior rhinoscopy, performed in all subjects before rhinomanometry.

We documented the personal data of each child, the personal and family history (fundamentally referred to the respiratory system), surgical operations in the zone, and the existence of good nasal breathing as evaluated by the children and their parents.

Nasal examination in turn comprised evaluation of the morphology and competence of the nasal pyramid, the nasolabial angles and the muscle components in the zone. Palpation was used to assess anatomical irregularities of the pyramid, crests and rigidities, while a nasal speculum was used to evaluate mucosal colour and the morphology of the nasal septum.

The children were considered to be healthy in the presence of normal exploration findings and a questionnaire without evidence of objective or subjective nasal problems.

Rhinomanometric exploration

Rhinomanometry was performed following the guidelines of the International Committee on Standardization of Rhinomanometry.[3]

All tests were made between 16:00 p.m. and the 20:00 p.m.

Since physical exercise is known to exert a vasoconstrictive effect,[16] the children were kept at rest in the sitting