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CLINICAL STUDY

Can reversibility of nasal obstruction predict the grade of bronchial hyperreactivity?

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Abstract: *Objective:* Aim of the study was to reveal the connection between significance of nasal obstruction and bronchial hyperreactivity.
Background: Allergic rhinitis is the most common IgE-mediated disease with progressively increasing prevalence in population. Chronic inflammation and remodelation of mucosa of the upper airways can be a part of generalized affection of respiratory system including lower airways. Severe inflammatory damage of nasal mucosa is connected with irreversibility of nasal obstruction, which is possible to verify by nasal decongestion test.
Methods: Bronchoprovocation test and rhinomanometry examination with decongestion test were performed in 57 patients. We analysed the grade of bronchial hyperreactivity and response of nasal mucosa to decongestion agent. Number of positive and negative decongestion tests were compared in a group of patients with mild bronchial hyperreactivity with the group of moderate and severe hyperreactivity.
Results: Comparing the results of decongestion tests there has been a significant difference found between the group with mild hyperreactivity and the group with moderate and severe hyperreactivity.
Conclusion: The study points out to narrow relationship between bronchial asthma and allergic rhinitis, where patients with negative decongestion test showed significantly increased grade of bronchial hyperreactivity. Due to this patients with insufficient response of nasal mucosa to decongestive agent probably require more intensive antiinflammatory therapy compared to patients with positive response. Nasal decongestion tests can be used for examination of the effect of allergic inflammation of nasal mucosa on the lower airways and vice versa *(Tab. 4, Ref. 27)*. Full Text in PDF *www.elis.sk.*
Key words: nasal decongestion test, nasal obstruction, allergic rhinitis, bronchial hyperreactivity, rhinomanometry.

Allergic rhinitis is the most common IgE-mediated disease with increasing prevalency in population (1). It is characterized by several typical symptoms from which nasal obstruction is the most important and is associated with allergic inflammation (2). Nasal obstruction can be evaluated either subjectively by visual analogue scale, or objectively by measurement of nasal resistency by rhinomanometry. Measurement of nasal resistency offers quantitative evaluation of the significance of nasal obstruction (3).

Allergic rhinitis is significantly associated with irreversible nasal obstruction caused by chronic inflammation and remodelation of nasal mucosa (4). Chronic inflammation and remodelation of mucosa of the upper airways can be part of general dysruption of respiratory system including the lower airways. Eosinophilic inflammation is a characteristic sign of allergic diseases. Increased level of eosinophils in the blood is associated with allergic inflammation, however it is not specific (5). Increased level of IgE is typical for atopy.

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Several studies focus on the important role of nasal provocation tests in the diagnostic algorithm of allergic rhinitis (6–11), however the importance of decongestion tests in clinical practice is not satisfactorily elucidated. There were several studies published which focused on nasal mucosa directly with nasal decongestion tests (2, 4, 12–15), however studies that focus on concomitant examination of reaction of the mucosa of upper and lower airways are very rare (1).

Nasal decongestion test evaluates percentual reversibility of nasal obstruction after intranasal application of vasoconstrictor agent (2). While bronchodilation test with beta-2-mimetics plays a key role in diagnosis of bronchial asthma, decongestion test is considered rather prognostic method for rhinitis (15).

The aim of our study was to evaluate the significance of nasal obstruction on the basis of response to decongestive agent in patients with mild bronchial hyperreactivity compared to patients with moderate and severe bronchial hyperreactivity. We observed also possible correlation of eosinophilia and increased serum concentration of total IgE antibodies with irreversible disruption of nasal mucosa and degree of bronchial hyperreactivity.

Methods

There were 68 patients with bronchial hyperreactivity and concomitant allergic rhinitis enrolled in to the study.

Tab. 1. Average FlowT (ml/s) in patients‘ groups.

Hyperreactivity	Basal	After decongestion	Increase of FlowT (%)
Mild	601 (±138)	873 (±169)	+31%
Moderate and severe	585 (±163)	686 (±175)	+15%

Tab. 2. Results of decongestion tests (mild vs moderate and severe hyperreactivity).

Decongestion test	positive	negative	Chi-square statistical significance
Mild hyperreactivity	28	8	p<0.001
Moderate and severe hyperreactivity	6	15	

Non specific bronchoconstriction test was performed for confirmation of the degree of bronchial hyperreactivity in all patients. For confirmation of concomitant rhinitis otorhinolaryngologist examination was performed. 11 patients with significant anatomical abnormalities in nasal cavity were excluded from the study. 57 patients underwent rhinomanometry examination with decongestion test. Serum IgE levels were detected in most patients, as well as serum eosinophil count.

Bronchoprovocation test

For confirmation of bronchial hyperreactivity aerosol of methacholin was used in 20 cases in double dose increased concentrations (0.125, 0.25, 0.5, 1.0, 2.0, 4.0, 8.0, 16.0 mg/ml) with total cumulative dose of 230,9 µg (16), in 48 cases aerosol of histamin was used in double dose increased concentrations (0.1, 0.2, 0.4, 0.8, 1.5, 3.0, 6.0, 12.0 mg/ml) with total cumulative dose of 172,8 µg (17). Bronchoprovocation test was positive (i,e. bronchial hyperreactivity was confirmed) in case of 20 % decrease of FEV1. On basis of PC_{20} the patients were divided in to the group with mild hyperreactiviyty and the group with moderate and severe bronchial hyperreactivity.

Rhinomanometry

Nasal flow was measured by anterior active rhinomanometry (Sanascope, Ganshorn Gmbh, Nemecko). Airflow through right nasal passage (Flow R (ml/s) and left nasal passage (Flow L (ml/s)) and total airflow (Flow T (ml/s)) with standardized pressure of 150 Pa was measured (basal rhinomanometry) (18).

Decongestion test

Immediately after basal rhinomanometry 2 doses of 0.2 % xylomethasoline (Olynth) were applied to both nasal passages with subsequent application of 1 dose of xylomethasoline after 5 minutes. Rhinomanometry was repeated 15 minutes after basal rhinomanometry.

Decongestion test was positive in case of symmetrical increase of FlowT minimally for 120 ml/s (accordingly to minimally 25 % increase of FlowT) (1). In case of non significant increase of FlowT or decrease of FlowT after decongestive agent, the test was evaluated as negative.

Statistical analysis

Statistical analysis was performed using Arcus QuickStat Biomedical and Microsoft Excel.Student t-test was used for comparison of FlowT values before and after decongestive agent administration. Comparison of positive and negative decongestive patients in the group with mild bronchial hyperreactivity compared to moderate and severe hyperreactivity was evaluated by Chi quadrate test and Fisher‘s test. Comparison of total serum IgE and eosinophils in the group of patients with mild bronchial hyperreactivity to the patients with moderate and severe hyperreactivity was performed using Fisher‘s test.

Results

In our group of 57 patients there were 25 men and 32 women with average age of 40 (±11.08) years from 20 to 61 years. 36 patients had mild hyperreactivity and 21 had moderate or severe bronchial hyperreactivity.

Average level of total airflow (FlowT) before administration of decongestive agent was 593 ml/s, and after xylomethasoline it increased to 811 ml/s. In Table 1 a summary and comparison of FlowT values in patients‘ groups is showed. In the group with mild hyperreactivity 28 tests were positive and 8 were negative, in the group with moderate and severe hyperreactivity there were 6 positive and 15 negative decongestion tests (Tab. 2). Comparing the results of decongestion tests there has been a significant difference found between the group with mild hyperreactivity and the group with moderate and severe hyperreactivity ($p<0.001$).

Results of total serum IgE antibodies and eosinophils are shown in tables 3 and 4. Serum eosinophil count and total serum

Tab. 3. Total IgE antibodies (mild vs moderate and severe hyperreactivity).

Concentrations of serum IgE	Mild hyperreactivity number of patients (in %)	Moderate and severe hyperreactivity number of patients (in %)	Fisher‘s test statistical significance
Increased	16 (51.61 %)	12 (85.71 %)	p<0.05
Normal	15 (48.39 %)	2 (14.29 %)	

Tab. 4. Serum eosinophil count (mild vs moderate and severe hyperreactivity).

Serum eosinophil count	Mild hyperreactivity number of patients (in %)	Moderate and severe hyperreactivity number of patients (in %)	Fisher‘s test statistical significance
Increased	11 (40.74 %)	10 (76.92 %)	p<0.05
Normal	16 (59.26 %)	3 (23.08 %)	

IgE was significantly higher in the group with moderate and severe hyperreactivity compared to the group with mild hyperreactivity ($p<0.05$).

Discussion

The aim of the study was to find a relationship between reversibility of nasal obstruction and significance of bronchial hyperreactivity verified by bronchoprovocation test.

Results of decongestion tests showed significantly positive effect of xylomethasoline in the group of patients with mild bronchial hyperreactivity on the increase of nasal flow in both nasal passages (FlowT) in average by 31%, compared to non-significant decongestive effect in the patients with moderate and severe hyperreactivity with increase of nasal flow (FlowT) in average by 15 %. There was a statistically significant difference found between these two groups in positive and negative decongestion tests. In the group of patients with mild hyperreactivity there were 28 positive tests and 8 negative, whereas in the second group there were only 6 positive tests and 15 negative. The results pointed to negative correlation between reversibility of nasal obstruction and the grade of bronchial hyperreactivity. We suppose that nasal mucous membrane with inflammatory changes can lead to decreased xylomethasoline effect which was confirmed in Italian studies, where nasal mucosa with inflammatory changes showed weak response to decongestive agent (15).

On the contrary bronchial mucosa with inflammatory changes can lead to increased methacholine and histamine effect and increase of bronchial reactivity (19, 20).

It is shown, that grade of decreased reversibility of obstruction (verified by decongestion test) is associated with severity of allergic inflammation (verified by grade of hyperreactivity). It was shown in study of Ciprandi, in which he pointed to correlation of nasal flow and FEF25–75 and bronchial hyperreactivity, where decreased nasal airflow was a predisposition for bronchial disorder (21).

From this fact it is possible to conclude that decongestion tests can indirectly point to the grade of inflammation of nasal mucosa.

Our findings correlate with conclusions of other authors, where patients with positive decongestion test showed the lowest grade of bronchial hyperreactivity (1). This confirms close relationship between bronchial asthma and rhinitis (22–26).

Increased serum total IgE antibodies were higher in the group of patients with moderate and severe hyperreactivity compared to the group with mild hyperreactivity with statistically significant difference . There was an incresed serum eosinophil count found in the group with moderate and severe hyperreactivity compared to the group with mild hyperreactivity with statistically significant difference.

The importance of decongestion test comprises of confirmation of reversibility of nasal obstruction. The question is its usage as a method for distinguishing anatomical nasal abnormality (irreversible obstruction) from functional abnormality, which is caused by mucous edema (reversible obstruction) as was shown by some authors (27).

Nasal decongestion test is mainly a prognostic method which indirectly points to the significance of affection of nasal mucosa. It means that nasal mucosa with inflammatory changes showed weaker response to decongestive agent. Due to this fact the patients with insufficient response of nasal mucosa to decongestive agent probably need more intensive anti-inflammatory therapy compared to the patients with positive response.

Bronchial hypereactivity is a marker of disorder – inflammation of bronchial mucosa. Because of existency of connection between rhinitis and asthma, nasal decongestion tests can be used in further research on the influence of the allergic inflammation of nasal mucosa on the lower airways and vice versa, which was confirmed also by our results.

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