International Journal of Pediatric Otorhinolaryngology (2004) **68**, 1407–1411

ELSEVIER

International Journal of Pediatric Otorhinolaryngology

www.elsevier.com/locate/ijporl

Nasal obstruction and headache
A real correlation?

Desiderio Passàli[a,*], Valerio Damiani[a], Francesco Maria Passàli[b], Giulio Cesare Passàli[a], Luisa Bellussi[a]

[a]*ENT Department—University of Siena Medical School, V.le Bracci, 53100 Siena, Italy*
[b]*ENT Department—University of Genoa Medical School, Genoa, Italy*

Received 18 February 2004; received in revised form 16 May 2004; accepted 21 May 2004

KEYWORDS
Nasal obstruction;
Headache;
Nasal allergy;
Children

Summary

Objective: to evaluate the relationships between headache and nasal obstruction or nasal allergy on a group of Italian school children.
Methods: One hundred twenty-six children suffering from headache, were enrolled in the study. All patients underwent an accurate clinical history, a complete ENT objective examination, an Anterior Active Rhinomanometry, an analysis of nasal mucociliary transport time and a skin test on the inner forearm.
Results: Nasal resistances were increased in 101 out of 105 of children (96.2%) affected by severe headache (group A) and in 5 out of 21 (23.8%) of those affected by sporadic headache ($P < 0.0001$), for an odds ratio of 80.0 (95% CI, 19–343).
The analysis of mucociliary transport time offered results comparable with those of the Anterior Active Rhinomanometry.
Conclusions: Dysfunctions of nasal physiology, as stated by the alteration of nasal resistances and nasal mucociliary transport, seem to be able to affect the development and the characteristics of headaches; specifically we found that children with an altered nasal physiology have more severe and more frequent attacks of headache.

1. Introduction

Headache represents an extremely common health problem in children, affecting many aspects of daily activities in this class of patients [5].

Epidemiological analyses showed that this pathology affects about 15–20% of schoolchildren, the 3–5% of them presenting classical migraine [14] and with two peaks of greatest incidence between 6 and 8 years of age and between 10 and 13 [8].

The severity of the impairment of the social and scholastic activities of patients is extremely variable and is strongly affected by the intensity and frequency of headache attacks; however, in this context, Carlsson recently reported that about

* Corresponding author. Tel.: +39 0577 40035; fax: +39 0577 47940.
E-mail address: passali@unisi.it (D. Passàli).

0165-5876/$ – see front matter
doi:10.1016/j.ijporl.2004.05.008

26% of children of his sample was affected by headache once a month instead 6% referred to be affected by this pathology several times a week or daily [4]. Moreover, it is important to bear in mind that headache is not an unique nosologic entity, in fact this generic definition includes a broad range of different pathologies.

Most important clinical data for the definition and the characterization of the different typologies of headaches are: age of onset of headache, time of headache, duration, location, frequency, severity, characteristics of headache, signs and symptoms associated with, triggers or precipitating factors and signs of neurological dysfunctions.

According to the above mentioned parameters, the International Headache Society (IHS) recently divided headaches into two broad categories: ''essential (or primary) headaches'' and ''symptomatic (or secondary headaches)'' [7].

In the paediatric age, most common essential headaches are represented by tension headaches, migraines and cluster headaches, whereas secondary headaches are mainly caused by intracranial or extracranial infections or inflammations, intracranial mass lesions and head and neck traumas [3].

Among extracranial infections or inflammations, rhinosinusitis certainly merits a particular mention. According to the IHS, the diagnostic criteria for acute sinus headache are: presence of purulent nasal discharge, pathological radiological sinusal findings, simultaneous onset of headache and sinusitis or headache localized to specific cranio-facial areas [2]. In addition, the typical sinusitis pain is generally present in the morning because of the accumulation of secretions throughout the night, with reduction or disappearance during the day, as a result of the partial or total draining of the exudate.

Moreover, recent evidences suggest that headache can also develop from nasal respiratory failure.

Rhinologic headaches, also called middle turbinate headache syndrome or rhinopatic headaches, are of that sort which arise from nasal mucosa as a result of a chronic alteration of the physiologic mechanisms of the rhinosinusal district.

In these patients the headache seems to be related to changes induced by vascular congestion of middle turbinates in the cerebral microcirculation (because of connections existing between ethmoidal and endocranial vessels), which, in turn, determine a chronic condition of hypoxia–hypercapnia and the release of cephalalgic neurotrasmitters [11].

However, this correlation is not unanimously accepted by the international scientific community.

At last, some Authors showed that nasal and other allergic symptoms commonly occur in migraine and other neurovascular headaches; for example, Wilson, in 1980, found that 25% of patients with migraine experienced rhinitis in association with their attacks [16] and Barbanti affirmed, in a recent report, that up to 67% of migraineurs had nasal and/or ocular disturbances during their headaches [1].

These and other data [13,12] have led to the hypothesis that migraine is a manifestation of an allergic sensitisation of the patient, but no definitive conclusions can be drawn on the basis of the data collected till now.

In view of the lack of definitive conclusions on this field, the aim of the present study was to evaluate the possible effects of nasal obstruction or nasal allergy on headache in children, specifically focusing on the effects of these factors on the severity of the attacks.

2. Materials and methods

One hundred twenty-six consecutive children affected by headache, were enrolled in the study. All the enrolled patients underwent an accurate clinical history, focused on the definition of the characteristics of their headache and on the identification of nasal pathologies and a complete ENT objective examination.

Moreover, they underwent, in order to analyse in an objective way their nasal ventilatory function, an Anterior Active Rhinomanometry (Menfis Rhino System, Menfis Biomedica, Bologna, Italy), without pharmacological decongestion.

They also were subjected to an analysis of nasal mucociliary transport function, that was investigated, according to a methods proposed by our School [10], by measuring the time required for charcoal powder placed on the inferior turbinate to reach the pharynx, the so called mucociliary transport time (MCTt). At last, they underwent a skin test on the inner forearm.

Allergens tested were chosen among those most commonly responsible of nasal allergy in Central Italy: Graminaceae (Holcus Lanatus and Cynodon Dactylus), Composites (Artemisia Vulgaris), Parietaria Officinalis and Dermatophagoides Pteronissinus.

According to the frequency of attacks and of the impairment of the daily activities of patients, we divided patients into two groups, a first group (group A: 106 children) consisting of children affected by various attacks of headache per month with a significant impairment of their daily life, and a second one, composed by children suffering from sporadic headaches with no significant effects on their daily activities (group B: 20 children).

All the collected data were subjected to a statistical analysis by using Chi-square test.

Informed written consensus was signed by the parents of all the children enrolled in the study. The study was approved by the Ethical Committee of Siena University.

3. Results

Out of 126 headache suffering enrolled children, 57 (45%) were males and 69 (55%) were females. Patients' ages ranged from 5 to 16 years (mean ± S.D.: 10.45 ± 2.65 years).

Focusing on clinical history, nasal obstruction and rhinorrhoea were present in about 84 and 64% of children, respectively; moreover sneezing was reported by 51% of patients and hyposmia affected about 16% of the sample.

Concerning the localization and on the characteristics of pain, 75,5% of children affected by headache localized their symptoms in the frontal area and 12,5% of them referred it as in attacks; moreover, in another 12% of children pain was associated with others symptoms such as visual disturbances, nausea, vomiting, etc.

Table 1 PRICK test

PRICK test results	Group A	Group B	All patients
Positive	60 (60%)	20 (76.9%)	80 (63.5%)
Negative	40 (40%)	6 (23.1%)	46 (36.5%)
All outcomes	100 (100%)	26 (100%)	126 (100%)

Evaluation of results according to the characteristics of headeaches. Group A: severe headache; group B: sporadic headache. $P = 0.6$.

ENT objective examination revealed an hypertrophy of inferior turbinates in 63 children, a septal deviation in 11, the coexistence of inferior turbinates hypertrophy and septal deviation in 32, and a normality of the anatomy of the rhinosinusal region in 20 of them.

Considering the whole enrolled population, PRICK tests resulted positive in 80 out of 126 children (64%) and negative in 46 of them (36%).

Total nasal resistance values, measured by Anterior Active Rhinomanometry, were within the norm (normal value: 0.15–0.64 Pa/cm^3 per second) in 20 patients, whereas 106 children showed altered nasal resistances, being >1 Pa/cm^3 per second in all of them (mean value: 1.35 ± 0.25 Pa/cm^3 per second).

The analysis of mucociliary transport time offered results comparable with those of the Anterior Active Rhinomanometry; in fact, it was normal (mean value: 8±3 min) in 20 children (the same 20 that had normal nasal ventilation) and altered in 106, being >18 min in all children of the latter group (mean value: 22.5 ± 1.5 min).

We compared the above described objective data with the characteristics of headaches (group A versus group B patients).

Analysing the relationship between allergic sensitisation and headache, we found that there was no significant association between PRICK results and headache type ($P = 0.6$).

Focusing on the alterations of nasal resistances (Table 2), we highlighted an alteration of this parameter (increase of resistances) in 101 out of 105 of children (96.2%) affected by severe headache (group A) and in 5 out of 21 (23.8%) of those affected by sporadic headache ($P < 0.0001$), for an odds ratio of 80.0 (95% CI, 19–343).

Table 2 Nasal resistances measured by Anterior Active Rhinomanometry

Nasal resistances	Group A	Group B	All patients
Increased	101 (96.2%)	5 (23.8%)	106 (84.1%)
Normal	4 (3.8%)	16 (76.2%)	20 (15.9%)
All outcomes	105 (100%)	21 (100%)	126 (100%)

Evaluation of results according to the characteristics of headeaches. Group A: severe headache; group B: sporadic headache. $P < 0.0001$.

Table 3 Mucociliary transport time

Mucociliary transport time	Group A	Group B	All patients
Prolonged	101 (96.2%)	5 (23.8%)	106 (84.1%)
Normal	4 (3.8%)	16 (76.2%)	20 (15.9%)
All outcomes	105 (100%)	21 (100%)	126 (100%)

Evaluation of results according to the characteristics of headaches. Group A: severe headache; group B: sporadic headache. $P < 0.0001$.

At last (Table 3), 101 out of 105 group A children and 5 out of 21 group B ones showed a prolonged mucociliary transport time ($P < 0.0001$) for an odds ratio of 80.0 (95% CI, 19–343).

4. Discussion

Headache is certainly one of the most common symptoms referred by patients requiring medical cares. The National Headache Foundation estimated that, in USA, headache comprises for a total medical costs of about 50 billion of dollars per year [6].

Moreover, in the pediatric age, it represent an extremely important medical and social problem, also for its strong impact on the quality of life and on the future cognitive development of the young patients.

Headaches are most commonly due to physiopathological processes developing in or around the skull, but, in some cases, phenomena arising in other districts can play an important role in the development of this kind of pathologies, too. In this context, the concept that headache can have a nasal origin had been introduced in Literature since the first decades of 1900 [15]; moreover, in 1949, Wolff [17] gave an experimental support to this hypothesis by obtaining, after the mechanical or chemical stimulation of the mucosa of middle turbinates, a referred pain localized both under the eyes and along the zigoma to the temple. Thus, an alteration of nasal homeostasis can be felt in the face or head.

In our sample, dysfunctions of nasal physiology, as stated by the alteration of nasal resistances and nasal mucociliary transport (Tables 2 and 3), seem to be able to affect the severity and the characteristics of headaches in predisposed patients; specifically we found that children with an altered nasal physiology have more severe and more frequent attacks of headache ($P < 0.0001$).

The mechanism affecting the severity of headache in these patients could reasonably be the vascular congestion of middle turbinates; the stasis of blood flow at this level, thanks to the connections existing between ethmoidal and endocranial vessels, leads to the release of vaso-active substances which, in turn, trigger the headache. Moreover, it is important, in this context, to bear in mind that the mucosa of middle turbinates has a rich sensory innervation thanks to the sensory nervous fibres originating from the semilunar ganglion of the trigeminal nerve; however, also the sensorial stimuli coming from the scalp, the dura and cranial vessels reaches the trigeminal nuclei. With sensory information from both the nasal mucosa and supratentorial structures projecting on the same neuron, it is easy to understand how referred pain can occur.

On the contrary, the hypothesis that nasal allergy, as suggested by some Authors [13,12,9], could play a major role in the genesis of headache is not confirmed by our data: an allergic sensitisation was detectable in both severe headache sufferer and mild headache sufferer children of our sample; moreover, 40 out of 46 children with negative PRICK test experienced severe headaches, with no statistically significant difference between the two groups (Table 1) ($P = 0.6$).

According to our data, an accurate evaluation of the rhinosinusal district acquire a strong rationale in all the children affected by both typical and atypical headache, in order to promptly discover the cases in which the deregulation of the rhinosinusal homeostasis could play a role in the pathogenesis of the disease.

An early identification of these initial alterations could, if an adequate treatment is promptly carried out, significantly affect the natural history of headaches in this group of children so to greatly increase their quality of life.

References

[1] P. Barbanti, G. Fabbrini, M. Pesare, Neuro-vascular symptoms during migraine attacks, Cephalalgia 21 (2001) 291–295.
[2] H.J. Blumenthal, Headache and sinus disease, Headache 41 (2001) 833–838.
[3] L.J. Burton, B. Quinn, J.L. Pratt-Cheney, M. Pourani, Headache aetiology in pediatric emergency department, Pediatr. Emerg. Care 13 (1997) 1–4.
[4] J. Carlsson, Prevalence of headache in school-children: relation to family and school factors, Acta Paediatr. 85 (1996) 692–696.
[5] G. Deda, H. Caksen, A. Ocal, Headache etiology in children, a retrospective study in 125 cases, Pediatr. Int. 42 (2000) 668–673.
[6] S. Diamond, The management of migraine and cluster headache, Compr. Ther. 21 (9) (1995) 492–498.
[7] Headache Classification Committee of the International Headache Society. Classification and diagnostic criteria for headache disorders, neuralgias and facial pain. Cephalalgia 1988;8(suppl 7):1–96.
[8] K.L. Hockaday, Headache in children, Maternal Child. Health 16 (1991) 246–247.
[9] G.F. Moore, J.D. Massey, J.M. Emanuel, Head pain secondary to nasal allergies, Ear Nose Throat J. 66 (1987) 41–53.
[10] D. Passali, L. Bellussi, M. Bianchini-Ciampoli, E. De Seta, Our experiences in nasal mucociliary transport time determination, Acta Otolaryngol. (Stockh) 97 (1984) 319–323.
[11] D. Passàli, L. Bellussi, F.M. Passàli, Rhinosinugenic headache, in: R. Mladina, D. Passàli (Eds.), Current Concepts in Pediatric Rhinology, 2000, PP. 190–193.

[12] A. Pradalier, J.M. Launay, Immunological aspects of migraine, Biomed. Pharmacother. 50 (1996) 64—70.
[13] D.E. Schuller, T.E. Cadman, W.H. Jeffreys, Recurrence headaches: what every allergist should know, Ann. Allergy Asthma Immunol. 76 (1996) 219—230.
[14] M. Silanpaa, P. Piekkala, P. Kero, Prevalence of headache in preschool age in an unselected child population, Cephalalgia 11 (1991) 239—242.
[15] G. Sluder, Vacuum frontal headaches with eye symptoms only, in: H. Kimpton (Ed.), Nasal Neurology, Headaches and Eye Disorders, St. Louis, Mosby, 1927, pp. 31—67.
[16] C.W.M. Wilson, J.G. Kinker, H. Warnes, The clinical features of migraine as a manifestation of allergic disease, Postgrad. Med. J. 56 (1980) 617—621.
[17] H.G. Wolff, Headache and Other Head Pain, Oxford University Press, New York, 1948 (pp. 446—471).