

ORIGINAL PAPER

Respiratory manifestations due to nickel

Manifestazioni respiratorie da nickel

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Key words

Rhinitis • Allergy • Nickel sulphate

Parole chiave

Riniti • Allergia • Nickel solfato

Summary

Nickel sulphate more frequently determines allergic dermatitis due to contact (contact eczema); less known are nasal inflammation (rhinitis) and bronchial asthma caused by nickel sulphate. Sporadic cases, often related to patients' work have been reported in the literature. The research described herein refers to 20 patients presenting clear nickel allergy with rhinitis (associated in 11 cases with asthma). The patients, all females, revealed positivity to this kind of allergy: patch test, prick tests with nickel sulphate, nasal provocation test by nickel sulphate, computed tomography of paranasal sinuses, spirometry and bronchial provocation test with metacholine, oral provocation test with nickel sulphate were employed. A strict long-term diet with food with low nickel content (2-4 months at least) led to a progressive reduction of nasal symptoms (rhinorrhea, sneezing, nasal obstruction) and an improvement in bronchial symptoms and functional parameters.

Riassunto

Il nickel solfato determina più frequentemente una dermatite allergica da contatto; assai meno note sono la rinite e l'asma bronchiale. In letteratura sono descritti casi sporadici spesso di natura esclusivamente professionale. Nel nostro lavoro descriviamo 20 pazienti allergici al nickel affetti da rinite associata in 11 casi ad asma bronchiale. I pazienti, tutti di sesso femminile, sono stati studiati oltre che con i consueti patch test con prick test per nickel, con test di provocazione nasale con nickel solfato, TC dei seni paranasali, spirometria e test di bronco-costrizione con metacolina ed infine test di provocazione orale con nickel solfato. Mediante rigorosa e prolungata dieta a basso contenuto di nickel (minimo 2-4 mesi) si è ottenuta una progressiva riduzione dei sintomi nasali e respiratori associati ad un miglioramento dei parametri di funzionalità respiratoria.

Introduction

Nickel is the allergen that most frequently produces professional contact eczema in females¹⁻⁴. Albeit other pathological localizations of allergy to nickel are steadily increasing: mucositis, oculo-rhinitis, asthma, urticaria⁵⁻¹⁵.

There are several groups of workers at professional risk (galvanic, metallurgic and mechanic industry workmen, hairdressers, cooks, tailors, goldsmiths, medical doctors, nurses), but the extra-professional hazard is also very important.

Nickel is present in many manufactured articles: costume jewelry, keys, pottery, furniture, clothes accessories; in soaps, in some natural foods (Table I) and in food cooked or packed in stainless steel food containers.

Females are more frequently affected than males (female:male ratio 14:1) and the allergy usually occurs in the third decade of life. Rhinitis caused by allergy to nickel, combined or not with asthma has been described in patients submitted to nickel exposure dur-

ing their working activity^{5 11-15}. Nickel may be absorbed by skin, lungs and the digestive system.

The present reports refers to 20 patients with rhinitis, associated in 11 cases with bronchial asthma, due to

Table I. Food containing nickel (modified from Venuti et al. ¹).

Herring	Corn and buckwheat flour
Asparagus	Hazel-nut
Bean	Mushroom
Onion	Fresh and cooked pear
Tomato	Rhubarb
Pea	Tea
Lettuce	Cocoa and chocolate
Cabbage	Beer
Raisin	Raising agents
Margarine	Wine

All foods canned or cooked in inox steel

allergy to nickel in females who had not experienced nickel exposure as a working risk.

Materials and methods

DESCRIPTION OF CASES

A series of 20 patients, all female, aged between 24 and 48 years (mean 33.7 ± 2) with chronic rhinitis were examined between January 1996 and June 2004 (asthma was present in 11 cases).

No respiratory allergy was revealed in the case history, but all patients had contact eczema, probably due to nickel sulphate.

Blood tests, spirometry, bronchoconstriction test with metacholine, total and specific dosage of IgE were all in the normal range.

METHODS

The following diagnostic procedures were carried out:

- patch test for metals (chrome, cobalt, nickel);
- prick tests for most common respiratory allergens (graminaceae, parietaria, dermatophagoides, alternaria etc.);
- prick tests for nickel (with 1 mg/ml and 10 mg/ml nickel sulphate (NiSO₄);
- ENT examination – either routine or with fibrolaryngoscopy;
- nasal provocation test for nickel performed with a small piece of cotton wool (diameter 1-2 mm) impregnated with NiSO₄ solution at a concentration of 10 mg/ml after a placebo test with physiological saline¹⁵. The cotton wool was applied to the anterior opening of the inferior nasal meatus for 1 hour as described elsewhere^{11 15}.

The patients were submitted to anterior active basic rhinomanometry and post nasal provocation test rhinomanometry. Student t test was used in the statistical analysis of the results (Table II). A significant difference in values was observed: 1.6 ± 0.5 Pa/cm²/sec. after the provocation test and 0.8 ± 0.1 Pa/cm²/sec. before the provocation test. Results were highly significant with a p value of < 0.01 .

The oral provocation test was performed, after 1 month on a low nickel diet, using capsules at a dosage of 5-10-20 mg (Lofarma test dose) (after

placebo provocation with lactose) which was taken at an increasing dosage at 1-week intervals.

During this test, cutaneous lesions, ventilation index (PEF, FEV₁), some symptoms (rhinorrea, nostril obstruction, cough, dyspnoea) were monitored.

Computed tomography (CT) of paranasal sinuses, as well as bronchoconstriction test with metacholine were carried out in patients with associated bronchial asthma.

Results

- Patch tests carried out for the most common metals revealed positivity only to nickel sulphate.
- ENT examination revealed chronic rhinitis in all the patients.
- CT of the paranasal sinuses demonstrated inflammation of sinuses and either turbinates hypertrophy in all the patients.
- Nasal provocation test was positive and provoked rhinorrea, sneezing and nostril mucosa increasing of oedema 15-30 minutes after inhalation of nickel sulphate.
- Rhinomanometry demonstrated an increase in nasal resistance in all patients in basal conditions; a further expansion of this parameter was observed also in the nasal provocation test (Table II).
- Prick tests for the most common respiratory allergens were negative.
- Prick tests for nickel were positive in one third of the patients (7 out of 20 patients).
- Metacholine provocation tests were positive in 11 cases (PD 20 Fev₁ 268 ± 25).

Discussion and conclusions

Rhinitis and asthma due to nickel sulphate allergy have very rarely been described in the literature^{2 3 5 6 11-15} and reports have referred to very few, or even only one patient. The paucity of data in this respect is due either to the rarity of this condition, or to the difficulty in formulating correct diagnosis, which can be reliably reached only by the finding of positivity to the nickel sulphate oral provocation test. In the group of females studied in the present investigation the allergy to nickel sulphate exposure not due to working

Table II. Rhinomanometry: values in Pa/cm³/sec. of nasal flow in patients with nickel allergy in basal conditions and after nickel provocation test¹⁵.

Basic rhinomanometry	Post nasal provocation test rhinomanometry	Student t test
0.8 ± 0.1	1.6 ± 0.5	$p < 0.01$

hazard was incontrovertible as also the nasal mucosa oedema (rhinitis) present in each patient. Moreover, prophylaxis and therapy with a diet low in nickel content are also difficult, since total compliance on behalf of the patient is necessary for at least 2-4 months for a reliable evaluation of effectiveness. Our patients confirmed that it is difficult to accept a strict and prolonged diet low in nickel content, but when achieved, a gradual and progressive reduction

in nasal or bronchial symptoms (cough, dyspnoea) or an improvement in functional parameters (PEF, FEV1, PD20, FEV1 = 467 ± 37) was observed, allowing a progressive reduction and withdrawal of symptomatic therapy (nasal corticosteroids or antihistamins).

One question remains unanswered: are rhinitis and asthma due only to Gell and Coomb's type I and type III reactions?

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