

Celery sensitivity: clinical and immunological correlations with pollen allergy

G. PAULI*, J. C. BESSOT*, A. DIETEMANN-MOLARD*,
P. A. BRAUN* and R. THIERRY†

**Service de Pneumologie, Centre Hospitalier Universitaire, B.P. 426, 67091 Strasbourg Cedex, and †Laboratoire de Bactériologie, Faculté de Médecine, 67085 Strasbourg Cedex, France*

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Summary

The authors studied twenty patients with celery allergy and concomitant hypersensitivity to certain pollens (mugwort, birch). The specific symptoms induced by eating celery were attacks of urticaria and angio oedema (seventeen out of twenty) respiratory complaints (eight out of twenty), systemic anaphylaxis with vascular collapse (three out of twenty). A strong association between clinical reactions to celery and mugwort sensitization, and to a lesser degree between celery allergy and birch pollen sensitization was established. Celery allergy is mediated by IgE antibodies and can be easily diagnosed by cutaneous tests using fresh material and/or by adequate RAST test. RAST inhibitions performed on individual sera suggest the existence of common antigens in celery and mugwort, and in celery and birch pollen. However, the exact nature of these common antigens has not yet been determined.

Introduction

Anaphylactic reactions to celery have been previously described [1, 2]; however the association of these celery induced allergic reactions with pollen sensitivity has been only recently emphasized [3–5]. In addition, in the cases reported in the literature, the suspected IgE mediated mechanism was rarely supported by specific IgE determinations.

We have identified a group of twenty patients with celery allergy who suffered from pollinosis or had at least positive cutaneous reactions to certain pollens, especially to mugwort or to birch pollens. The aim of the present study was to analyse the clinical features of these unexpected associations and to give the immunological proof for an underlying IgE mediated mechanism. The possible explanations for these relationships

Correspondence: Professeur G. Pauli, Service de Pneumologie, Centre Hospitalier Régional, B.P. 426, 67091 Strasbourg Cedex, France.

between pollen sensitization and celery allergy could be due to cross reacting allergens from taxonomically unrelated species. Employing the RAST inhibition technique, we have demonstrated the occurrence of partial immunological identity between antigens of mugwort pollens and celery, and of birch pollens and celery.

Material and methods

Subjects

The case series consisted of twenty patients (twelve women, eight men) who were referred to the allergy diagnostic unit. Their immediate relevant past history included either clinical manifestations of hypersensitivity to celery (nine cases) or pollinosis (eleven cases). In the latter cases, celery food allergy was discovered when the patients were questioned regarding food intolerance (nine cases) or occurred later during the patient's survey (two cases). They all admitted eating celery root salad though it is impossible to state in what quantity. Eleven out of twenty patients complained of other food allergies especially apple (seven cases), hazelnuts (four cases), carrots (five cases). In three patients, allergy to celery appeared during hyposensitization with weed pollen extracts.

Allergen extracts

The birch pollen and mugwort pollen were glycerinized extracts of *Betula verrucosa* and *Artemisia vulgaris* pollen (1:20, w:v, Laboratoires Stallergènes). Fifteen other common inhalant allergens were also tested.

For the celery cutaneous tests, we used commercial celery extract (1:20, w:v, Laboratoires Stallergènes). In addition, raw root celery was tested in fifteen cases either by laying the sliced root celery on the forearm or by using freshly extracted celery juice. All these extracts were tested in control subjects.

Skin tests

Skin prick tests with celery allergens were performed on the volar side of the forearm, the reactions were read after 15 min. For raw celery and pollens, we performed scratch tests and the reactions were also read after 15 min. Weal reactions were outlined with a ballpoint pen and the markings were transferred by means of tape. For prick tests, reactions were counted as + when the half mean weal cross-diameter did not exceed 5 mm, ++ when the half mean weal cross-diameter exceeded 5 mm but was less than 10 mm, +++ when the half mean weal cross-diameter was greater than 10 mm. For scratch tests, reactions were counted as follows: + when the half mean weal cross-diameter was between 10 and 20 mm; ++ between 20 and 30 mm; and +++ was greater than 30 mm.

Radioallergosorbent test (RAST)

Serum IgE antibodies to the different allergens were detected by RAST Phadebas [6] on undiluted sera. For celery IgE determinations we first used commercial celery disc extracts, subsequently solid phase allergens prepared by partially purified and concentrated root and leaf celery (provided by Professor S.G.O. Johansson, Uppsala) and finally a new type of commercial celery discs (provided by Pharmacia).

RAST inhibition

Initially, direct RAST were performed on adequately diluted native patient serum for mugwort or birch pollens. Results were expressed in Phadebas RAST Units (PRU).

For RAST inhibition 150 μ l of an adequately diluted patient serum and 150 μ l of crude celery juice were added in a polystyrene tube.

The crude extract of raw celery root was made just before use by crushing 20 g of root, followed by rapid homogenization and centrifugation for 5 min at 10 000 g. The tubes were incubated for 1 h at 37°C. A mugwort or birch pollen disc was added to 50 μ l of the suspension and the assay was continued using standard RAST methods. The results of the RAST inhibition were expressed as follows:

Pollen RAST in PRU native serum – Pollen RAST in PRU after absorption

Pollen RAST in PRU native serum

As a control, RAST inhibitions with crude celery juice were also performed on four sera provided by allergic patients without pollinosis and clinical symptoms of celery allergy (three allergic to *Dermatophagoides pteronyssinus*, one to cat epithelium).

Results*Clinical data*

Table 1 shows the main clinical data concerning the patients with special reference to the specific symptoms induced by eating celery. Most of the patients (seventeen out of twenty) had multiple attacks of urticaria and angio oedema, three had severe systemic anaphylaxis with vascular collapse, eight had suffered respiratory symptoms i.e. rhinitis with or without asthma. Isolated oral pruritis occurred only in two cases.

After the patients had been questioned regarding seasonal rhinitis, it appeared that only five were unable to confirm a pollinosis history, although they were immunologically sensitized to pollens. In eight cases, major exacerbations occurred during the mugwort season (i.e. July and August in France). In five cases, the patients suffered from spring pollinosis (March and April in France), in three cases, major complaints occurred during the grass pollen season (i.e. June in France).

Cutaneous tests

(Table 1). All the patients had immediate reactions to celery. Control skin tests with the same extract were negative in 25 control subjects indicating that the positive reactions were specific.

Sixteen out of twenty patients who had clinical symptoms of celery allergy reacted positively to mugwort. Among the four patients who did not react to mugwort, a high cutaneous sensitivity to Betulaceae pollen was detected; however, patients were sometimes allergic to several pollens.

RAST Results

(Table 2). For celery, IgE antibodies to celery were detected in seventeen out of twenty patients. Celery root RAST generally agreed with the history of symptoms and with results from skin tests with fresh celery. RAST tests to leaf celery were positive in only eight patients suggesting that the responsible allergen is poorly represented on leaf discs.

Table 1. Clinical data and skin tests in twenty patients with celery allergy

Patients	Age	Sex	Specific symptoms after eating celery	Pollinosis	Skin tests				
					Celery		Pollens (scratch)		
					scratch	prick	mugwort	grass	birch
Du.	45	F	AE, U, R, A	Late summer pollinosis	++	++	++	—	—
Te.	32	F	AE	—	++	++	++	—	—
Mat.	15	M	AE, U, R, A	June and late sum- mer pollinosis	+	+	++	+	—
Ng.	23	F	AE, U, A	June pollinosis	++	++	+	+	—
Be.	40	F	AE, U, R, C	Late summer pollinosis	+	+	++	—	—
Ki.	44	F	AE	—	++	++	+	+	—
Hi.	22	F	AE, U	June pollinosis	++	++	+++	++	—
Pe.	40	F	AE	Late summer pollinosis	ND	++	++	—	—
Das.	16	F	AE, U, A, C, SA	—	ND	++	+	—	—
Gul.	34	F	AE, U, A, SA	June and late sum- mer pollinosis	ND	+++	++	+	+
Wil.	14	F	AE, U, A, SA	June and late sum- mer pollinosis	+	+	+	++	—
Rh.	44	F	AE	June pollinosis	++	++	++	++	—
Ur.	35	M	AE, R, C	—	ND	+	++	—	—
Da.	30	M	OP, A, C	Spring and summer pollinosis	ND	++	++	+++	++
Ho.	28	M	AE, U, R, A, C	June and late sum- mer pollinosis	++	++	++	++	++
Per.	28	M	OP	Early spring and summer pollinosis	++	++	+	+++	+++
He.	29	M	AE	Early spring pollinosis	ND	++	—	—	++
Sto.	25	M	AE, R	—	++	++	—	—	++
Pi.	33	F	OP	Spring and summer pollinosis	ND	++	—	++	++
Web.	49	M	AE, U	Spring pollinosis	+	+	—	—	++

AE=angio oedema; U=urticaria; R=rhinitis; A=asthma; C=conjunctivitis; OP=oral pruritis; SA=systemic anaphylaxis; ND= not done.

For pollen, IgE antibodies to mugwort were found in fourteen out of twenty patients. In eight out of twenty patients, RAST results were positive to birch pollen with very strong values. In ten patients, RAST results were also positive for grass pollen.

RAST inhibition studies

(Table 3). For mugwort, the absorption procedure removed at least 30% of the specific IgE antibodies. For birch, a significant inhibition was observed in all cases, the percentage of inhibition being greater than 70% in three cases.

In the four control subjects allergic to *D. pteronyssinus* (three cases) and to cat

Table 2. RAST results for celery and pollen allergens in twenty patients with celery allergy

Allergens	RAST score				
	0	1	2	3	4
Celery root	3	1	13	2	1
Celery leaf	12	4	3	1	
Commercial celery (1)	17		1	2	
Commercial celery (2)	4	2	11	2	1
Mugwort pollen	6	1	3	5	5
Birch pollen	12		1	1	6
Grass pollen	10		5	2	3

Table 3. Results of mugwort or birch pollen RAST inhibition by celery juice

Patients	RAST (PRU) on diluted sera before absorption	RAST (PRU) on diluted sera after absorption by celery juice		% RAST inhibition
Pollen:Mugwort				
Be.	2.50	1.40		44%
Du.	2.70	1.30		52%
Da.	4	1		75%
Ma.	14	9.20		34.3%
Ng.	7.20	5		31%
Rh.	3.40	1.80		47%
Te.	3.10	1.70		41%
Hi.	9	6		33%
Pollen:Birch				
St.	12.19	6		50%
Da.	17.19	3.60		75%
He	6.29	1.50		77%
Pi.	15.40	3.60		77%

epithelia (one case) the RAST for the offending allergens were not inhibited after absorption by celery extracts.

Discussion

Hypersensitivity to various fruits and roots have been previously described especially among birch pollen allergic patients [7-11] but there is little in the literature regarding simultaneous sensitivities to celery and pollens. Eriksson *et al.* [12], in a study of 380 subjects with birch pollen allergy found that food sensitivity was associated in 53% of the cases, the most common food intolerance being apple allergy, celery allergy being only implicated in two cases. In a previous study, in a group of eighty-one birch pollen

sensitized subjects, we found ten having symptoms after eating celery [13]. By using cutaneous tests, Hannuksela and Lahti [8] found 18% positive reactions to fresh celery extracts among 148 allergic birch pollen patients. Similar cutaneous investigations were performed by Kaupinen and Kousa [2] in mugwort hypersensitive patients: twenty-nine out of fifty-five (i.e. 52%) reacted positively to celery. Kremser and Lindermayer [4] reported forty-nine patients (i.e. 56%) with positive RAST to celery amongst a series of eighty-nine cases with both positive mugwort cutaneous reactions and positive RAST (class ≥ 3).

For apple allergy, the most frequent symptoms are oral pruritis and labial oedema. In the cases of celery allergy we studied, symptoms were more severe and three systemic anaphylaxis occurred among the mugwort sensitive patients. These findings are in agreement with those reported by Kaupinen *et al.* [2] and Kremser and Lindermayer [4].

Concerning the methods of diagnosis, this study emphasizes the validity of cutaneous testing with raw celery, as it was outlined earlier by Hannuksela and Lahti [8]. The initial failure to obtain positive results with RAST methods did not reflect the absence of IgE antibodies to celery extract, but rather the inadequacy of the supplies of commercial discs to detect the relevant antibodies. Previous studies using Prausnitz-Kustner tests had demonstrated that vegetable and fruit hypersensitivities were mediated by reagents [14, 15].

At present, we cannot argue for a constant association between clinical celery allergy and pollen sensitization: our patients were included in this study because of celery intolerance. But even in the five patients of our series who were pollinosis symptom free, cutaneous tests and RAST tests brought immunological evidence of pollen sensitization, which should argue for systematic search for pollen sensitization in celery allergic patients. Though no systematic studies have been carried out among a larger series of celery allergic patients, we believe in a partial identity between pollens (especially mugwort and birch) and celery, which can be inferred from our clinical data and preliminary immunological results. So far, immunological investigations were based essentially on RAST inhibition: the inhibition of mugwort pollen RAST and birch pollen RAST with celery extracts indicates a partial immunological identity between antigens of mugwort and of celery, as well as between antigens of birch and of celery. No inhibition for other allergens especially for *D. pteronyssinus* was obtained with celery as inhibitor. Another study [16, 17], based on comparison of immunoelectrofocusing (IEF) spectrotypes of the celery allergens and mugwort also suggested the existence of common epitopes between celery and mugwort allergens recognized by selected patients' sera.

Several hypotheses have been proposed to explain the pollen related food hypersensitivity: lectines present in both food and pollens could induce non-immune binding of IgE. However, this non specific binding should be as frequent between all kinds of IgE antibodies. Besides, Aalberse [18] suggested that cross reacting carbohydrate determinants could be present in many vegetable foods, pollens and surprisingly Hymenoptera venom. But this was not confirmed in our study as none of the patients with celery allergy had any detectable specific IgE for bee and vespid venom. Moreover, in Aalberse's data, the IgE induced by carbohydrate antigens did not seem to give any clinical reactions whereas all our patients were selected on clinically relevant celery allergy. This why we think that it is not possible at the moment to assess the exact nature of the common antigens responsible for the unexpected association between pollinosis and celery allergy.

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References

- 1 Forsbeck M, Ros AM. Anaphylactoid reaction to celery. *Contact Dermatitis* 1979; 5:191.
- 2 Kaupinen K, Kousa M, Reunala T. Aromatic plants. A cause of severe attacks of angio oedema and urticaria. *Contact Dermatitis* 1980; 6:251-4.
- 3 Pauli G, Bessot JC, Kopferschmitt-Kubler MC, Braun PA. Allergie au céleri, allergie au pollen d'armoise, une nouvelle entité? *Revue Fr Allerg* 1982; 22:36.
- 4 Kremser M, Lindermayer W. Sellerieallergie (Selleriekontakturtikariasyndrom) und Zusammenhänge mit Allergien gegen andere Pflanzenantigene. *Wien klin Wschr* 1983; 838-43.
- 5 Dechamp C, Michel J, Deviller P, Perrin LF. Choc anaphylactique au céleri et sensibilisation à l'ambroisie et à l'armoise. Allergie croisée ou allergie concomitante? *Presse Méd* 1984; 13:871-4.
- 6 Yman L, Ponterius G, Brand TR. RAST based allergen assay methods. In: Karger S, ed. *Developments in biological standardization* 29, Basel: International Association of Biological Standardization Co, 1975: 151.
- 7 Juhlin-Dannfelt C. About the occurrence of various forms of pollen allergy in Sweden. *Acta Med Scand* 1948; 26:563-77.
- 8 Hannuksela M, Lahti A. Immediate reactions to fruits and vegetables. *Contact Dermatitis* 1977; 3:79-84.
- 9 Eriksson N. Food sensitivity reported by patients with asthma and hay fever. *Allergy* 1978; 33:189-96.
- 10 Eriksson N, Wihl JA, Arrendal H. Birch pollen-related food hypersensitivity influence of total and specific IgE levels. *Allergy* 1983; 38:353-7.
- 11 Lowenstein H, Eriksson NE. Hypersensitivity to foods among birch pollen allergic patients. *Allergy* 1983; 38:577-87.
- 12 Eriksson N, Formgren H, Svenonius E. Food hypersensitivity in patients with pollen allergy. *Allergy* 1982; 37:437-43.
- 13 Bessot JC, Dietemann-Molard A, Braun PA, Pauli G. Les associations de pollinose aux bétulacées et d'allergie alimentaire aux pommes et autres végétaux. *Revue Fr Allerg* 1984; 24:29-33.
- 14 Tuft L, Blumstein G. Studies in food allergy. II. Sensitization to fresh fruits: clinical and experimental observations. *J Allergy* 1942; 13:574-82.
- 15 Dreborg S, Foucard T. Allergy to apple, carrot and potato in children with birch pollen allergy. *Allergy* 1983; 38:162-72.
- 16 Peltre G, Pauli G, Ville G, David B. Simultaneous occurrence of IgE antibodies to ragweed pollen and to celery root in patients sera. *Folia Allergol Immunol Clin* 1983; 30:(suppl. 84) Abst.
- 17 Pauli G, Peltre G, Bessot JC, Braun PA, David B. Allergy to celery root coincident with mugwort pollen sensitivity. *J Allergy Clin Immunol* 1984; 73:(Suppl. 114) Abst.
- 18 Aalberse R, Koshte V, Clemens J. Immunoglobulin E antibodies that cross-react with vegetable foods, pollen and hymenoptera venom. *J Allergy Clin Immunol* 1981; 68:356-64.

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