

Parthenium dermatitis: is it a systemic contact dermatitis or an airborne contact dermatitis?

VIKRAM K. MAHAJAN, NAND LAL SHARMA AND RAMESH CHANDER SHARMA

Department of Dermatology, Venereology and Leprosy, Indira Gandhi Medical College, Shimla 171001, Himachal Pradesh, India

We describe here a *Parthenium hysterophorus* patch-test-positive patient with widespread dermatitis of non-airborne contact dermatitis pattern, improving while staying in Shimla (a parthenium-free area) and rapidly worsening while visiting his native place, where there was exuberant parthenium growth. After recovery, inhalation of fresh plant material from a polythene bag resulted in exacerbation of dermatitis and pruritus within 8–10 hr, without any respiratory symptoms. The possible pathomechanism of such a phenomenon is discussed.

Key words: airborne contact dermatitis; Compositae; *Parthenium hysterophorus*; plants; systemic contact dermatitis. © Blackwell Munksgaard, 2004.

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Parthenium hysterophorus is one of the commonest cause of allergic contact dermatitis and cases have been reported in almost epidemic proportions from all over India. The weed has high sensitizing potential and has been found to sensitize as many as 56% of occupationally exposed persons without causing apparent dermatitis (1).

The exact mechanism of sensitization is unknown; the trichomes, pollen and plant dust containing sesquiterpene lactones (SLs), the major antigens, become airborne and cause airborne contact dermatitis in the majority. Direct or indirect contact sensitization is also possible in view of the rampant growth of the weed (2). Although pollen does not carry significant SLs and detritus is plentiful only after plants die, sensitization occurs more frequently during the weed's growing season when there is little dust (3). Thus, sensitization only by airborne SLs, either contained in plant parts or released into the air, may not be the only explanation for *P. hysterophorus* causing airborne contact dermatitis.

Case Report

A 35-year-old male office worker was hospitalized with a widespread rash for which an initial provisional diagnosis of subacute cutaneous lupus erythematosus was considered. He had

been having episodes of widespread, discrete and confluent, erythematous-squamous rash associated with intense itching, for the last 2 years. There was a history of summer exacerbation and improvement during winters and on change of place.

On examination, there were widespread, symmetrical, erythematous papulo-squamous lesions, sparing major flexures such as the upper eyelids, retro-auricular folds, neckfold, cubital and popliteal fossae, axillae and groins. Lesions were covered with loose, moist scales. The fingernails had a smooth, shiny, polished appearance. Hair and mucous membranes were normal. There was painless posterior cervical and inguinal lymphadenopathy. Systemic examination was normal. Laboratory investigations did not show any abnormality. Fine needle aspiration cytology from one of the enlarged lymph nodes showed reactive hyperplasia. Pending further investigation, he was prescribed oral antihistamines and topical emollients.

On the 3rd day of hospitalization, although the cutaneous lesions showed improvement, their eczematous morphology became more evident. Further treatment with oral prednisolone (30 mg/day) resulted in their complete clearance within a week. Histopathological investigation now showed hyperkeratosis, acanthosis and mild perivascular dermal inflammation comprising eosinophils and lymphocytes, suggestive of

dermatitis. Patch testing with the Indian standard series including parthenium (4) showed a strong positive (+++) reaction to aqueous extract of *P. hysterophorus*. Direct enquiry at this stage established that there was abundant growth of *P. hysterophorus* in his native place, although he had never handled it himself. With a diagnosis of parthenium dermatitis, the patient was discharged on oral azathioprine 100 mg/day and advised to avoid exposure to the weed.

However, he was rehospitalized after 3 days with severe exacerbation of dermatitis immediately after returning to his native place. His dermatitis improved without topical or systemic corticosteroids over the next few days. An unusual mechanism of parthenium sensitivity was suspected because of atypical clinical features, viz. a florid widespread dermatitis of non-airborne contact dermatitis pattern and immediate exacerbation on return to his native environment. To test the hypothesis that his sensitivity might be due to inhalation, he was asked to inhale (5 nasal inspirations) directly from a polythene bag containing fresh intact whole *P. hysterophorus* plants (including flowers), taking care not to expose his skin to the weed. This procedure was carried out on 2 separate occasions. There was exacerbation of his pruritus and dermatitis on both such occasions within 8–10 hr. However, there were no apparent nasobronchial symptoms.

A prick test with 20% aqueous parthenium extract, crushed parthenium plant extract and normal saline (for control) showed no immediate (after 15 min) wheal formation. Pruritic, erythematous and indurated nodular lesions developed at the prick test sites (with parthenium extracts) after 24 hr. Biopsy from one of these nodular lesions showed features suggestive of allergic leukocytoclastic vasculitis (Fig. 1), characterized by fibrinoid necrosis of dermal capillaries with nuclear dust and moderate lymphocytic infiltrate mixed with a few neutrophils and eosinophils, the overlying epidermis showing minimal spongiosis.

A bronchoprovocation test (BPT) was carried out after obtaining baseline spirometry. During the procedure the patient inhaled from a polythene bag containing fresh intact whole *P. hysterophorus* plants. Repeat spirometry 10 min later showed some (<20%), though not a significant, fall in forced expiratory volume (FEV₁), which improved on its own after 24 hr. Similarly, there was improvement in FEV₁ 5 min after salbutamol inhalation on a subsequent BPT. On both occasions, 8–10 hr later, the patient experienced widespread pruritus and developed dermatitis over the legs.

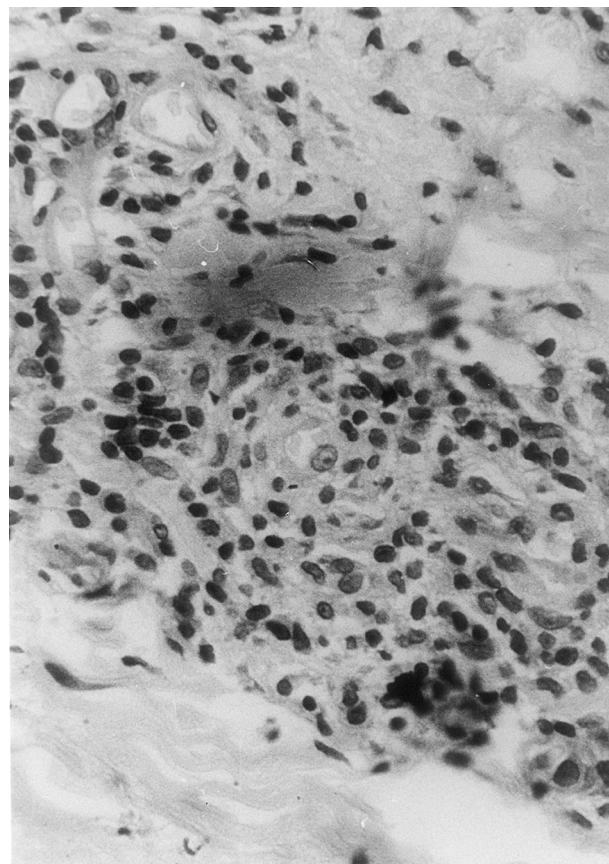


Fig. 1. Histopathology of prick test site nodule showing intense vasculitic reaction in upper dermis ($\times 40$).

Discussion

Airborne contact dermatitis pattern is the most common clinical presentation of parthenium contact sensitivity (5, 6). The classic airborne pattern, photosensitivity pattern and chronic lichenified acral dermatitis were seen in 82.5%, 9.5% and 7.9% patients, respectively, in one Indian study (6). In addition, other patterns such as seborrhoeic, diffuse non-specific and localized dermatitis of the hands and face have also been documented (7).

The highest concentration of SLs (almost 8% of the dry weight of the plant) is found within the trichomes present over leaves and capitulum (8). This is important in view of the fact that these trichomes and other dried plant materials become windborne and are able to cause airborne contact dermatitis. It is possible that *P. hysterophorus* also contains volatile monoterpenes similar to those detected in the air around a closely related Compositae weed, *Tanacetum parthenium*, having the sensitizing potential to elicit allergic contact dermatitis (9, 10).

Apart from sensitization from direct or indirect contact with parts of the plant or its airborne

allergens, sensitization to parthenium might also be possible by inhalation or ingestion. This is evident from a recent study of attempted oral hyposensitization where as many as 30% of the patients experienced aggravation of their dermatitis during the procedure (11). Parenteral or enteral exposure to certain other allergens, including some drugs and metal salts (nickel, mercury, cobalt and chromium), is known to elicit a morphological and histological response similar to topically elicited allergic contact dermatitis. Some plants (poison ivy) and plant oleoresins are also known to elicit systemic contact dermatitis (12). Within this entity, apart from contact dermatitis, other patterns such as widespread rash, vasculitis, erythema multiforme and Stevens–Johnson syndrome have also been reported. Such non-eczematous reactions may result from ingestion, absorption or inhalation of allergen and have been postulated to be due to an overlap of type IV and type III (immune complex) reactions (13).

In our patient, the initial manifestation was a non-eczematous, non-airborne contact dermatitis type widespread rash, later developing into a more eczematous pattern. A negative immediate prick test, developing into a nodule with a leukocytoclastic vasculitic histology excludes type I hypersensitivity and suggests type III hypersensitivity mechanism (14). A positive patch test reaction to parthenium is consistent with a type IV hypersensitivity reaction and points towards systemic contact dermatitis. Perhaps both routes of exposure, viz. ingested or inhaled and cutaneous contact, may have been operative in our patient.

Parthenium hysterophorus has also been shown to be a significant cause of seasonal pollenosis and nasobronchial allergies attributable to a protein fraction of pollen. However, in clinical practice not many patients have contact dermatitis and nasal/bronchial allergy together due to parthenium. The exacerbation of dermatitis and pruritus in our patient, without significant bronchospasm or nasal allergy, following inhalation of fresh parthenium plants was interesting. Is it that *P. hysterophorus* contains aeroallergens as well as contact sensitizers without any cross-reactivity? Moreover, parthenium pollen does not carry significant SLs and has been shown to be not so potent a cutaneous sensitizer (3), although it is a potent aeroallergen for allergic rhinitis and bronchial asthma (15, 16). Mild alteration in FEV₁ values in BPT in our patient might have been due to a non-specific irritant effect.

We consider that sensitization due to *P. hysterophorus* is as complex as its allergenicity. It is also possible that *P. hysterophorus* contains different

sets of allergenic components, viz. aeroallergens, contact allergens, photoactive allergens and may be a few more, all manifesting separately with different clinical features. For instance, a water-soluble protein fraction could be an aeroallergen specific to the respiratory tract, causing nasobronchial allergy, while not yet identified skin-specific aeroallergens could bring about systemic contact dermatitis in already-sensitized individuals. Similarly, contact allergens too appear to comprise 2 separate sets of contactants, viz. airborne contactants causing airborne contact dermatitis and direct contactants precipitating contact dermatitis in persons handling the weed. Furthermore, *P. hysterophorus* appears to sensitize by a number of methods, singly or in combination.

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Address:
Dr Nand Lal Sharma
Department of Dermatology, Venereology and Leprosy
Indira Gandhi Medical College
Shimla 171001, Himachal Pradesh
India
Tel: +91 177 2883404
Fax: +91 177 2658339
e-mail: nandlals@hotmail.com