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Occupational contact urticaria and rhinitis caused by immediate allergy to palladium salts

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Case History

A 50-year-old previously healthy non-smoking laboratory technician, who had worked in catalyst research for 26 years, presented with recurrent urticaria on the hands and the face, and watery rhinitis associated with handling palladium salts at work. When exposed to fine dusts of dried and powdered mixtures containing the palladium nitrate salts $\text{Pd}(\text{NH}_3)_4(\text{NO}_3)_2$ and $\text{Pd}(\text{NO}_3)_2$, she immediately developed itchy facial erythema, which disappeared within hours. Occasional spillages of palladium salt solutions on the patient's bare forearms caused immediate urticarial wheals to appear on the contact site. She also suffered from watery rhinitis and sneezing, and itching of the eyes, when she was exposed to fine dust of ground materials that contained palladium salts. She had no symptoms suggestive of asthma. She was symptom-free during leisure time and when she handled compounds of other metals, that is, platinum, rhodium, vanadium, and aluminium.

Prick testing with common aeroallergens showed sensitization to tree pollens (Table 1). Prick tests with samples of two palladium compounds from the patient's workplace gave positive results. Control prick tests with tetraamminepalladium(II) hydrogencarbonate (1% aq.) and tetraamminepalladium(II) nitrate (10% aq.) gave no positive reactions in 40 volunteers. In 3 of the volunteers, 2-mm wheals were observed with both palladium compounds, and were interpreted as signs of mild irritation.

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Table 1. Results of prick tests, open skin application tests, and nasal provocation tests

Skin prick tests	
Histamine 10 mg/ml	5 mm
Diluent control	Negative
Common aeroallergens	Birch pollen 5 mm
	Alder pollen 3 mm
Tetraamminepalladium(II) hydrogencarbonate [$\text{Pd}(\text{NH}_4)_3(\text{HCO}_3)_2$, CAS no. 134620-00-1] in aq.	1% 9 mm
	0.1% 5 mm
	0.01% negative
Tetraamminepalladium(II) nitrate [$\text{Pd}(\text{NH}_3)_4(\text{NO}_3)_2$, CAS no. 13601-08-6] 10% in aq.	7 mm
Platinum(II) nitrate [$\text{Pt}(\text{NO}_3)_2$, CAS no. 18496-40-7], 0.67% in alkaline buffer	Negative
Ammonium hexachloroplatinate(IV) [$(\text{NH}_4)_2\text{PtCl}_6$, CAS no. 16919-58-7] 0.1% in aq.	Negative
Platinum(IV) oxide [PtO_2 , CAS no. 1314-15-4], 1% in aq.	Negative
Open skin application tests	
Tetraamminepalladium(II) hydrogencarbonate [$\text{Pd}(\text{NH}_4)_3(\text{HCO}_3)_2$, CAS no. 134620-00-1] 1% in aq.	Positive at 20 min
Tetraamminepalladium(II) nitrate [$\text{Pd}(\text{NH}_3)_4(\text{NO}_3)_2$, CAS no. 13601-08-6] 10% in aq.	Positive at 20 min
Patch tests	
Finnish baseline series	Negative
Palladium(II) chloride (2% in pet.; Chemotechnique, Vellinge, Sweden)	Negative
Patient's own substances from the workplace:	Negative
Tetraamminepalladium(II) hydrogencarbonate [$\text{Pd}(\text{NH}_4)_3(\text{HCO}_3)_2$, CAS no. 134620-00-1] 1% in aq.	

Table 1. Continued

Tetraaminepalladium(II) nitrate [Pd(NH ₃) ₄ (NO ₃) ₂ , CAS no. 13601-08-6] 10% in aq.	
Platinum(II) nitrate [Pt(NO ₃) ₂ , CAS no. 18496-40-7], 0.67% in alkaline buffer	
Platinum(IV) oxide [PtO ₂ , CAS no. 1314-15-4], 1% in aq.	
Nasal provocation tests	
NaCl 0.9% control	Negative; no rhinometric changes
Tetraaminepalladium(II) hydrogencarbonate solution in aq. (36 min)	0.001% negative; cyclic nasal reaction in acoustic rhinometry
	0.01% positive; rhinorrhoea 0.50 g, no rhinometric changes
	0.1% positive; rhinorrhoea 0.46 g, bilateral nasal volume change – 25%, bilateral nasal resistance change + 468%

Open skin application tests were performed by applying the test substance to a 5 × 5 cm area of healthy skin on the forearm for 20 min. In our patient, the open skin application tests with the two prick test-positive palladium salts gave positive results, with urticarial wheals appearing on the test areas (Table 1).

Nasal provocation tests were performed with tetraaminepalladium(II) hydrogencarbonate by administering 0.1 ml of the solution bilaterally. Positive nasal provocation test reactions to palladium salt at 0.01% and 0.1% were observed in the form of rhinorrhoea and changes in the measured nasal resistance and volume (2–5 cm)

(Table 1), although, in rhinoscopy, no nasal blockage was observed.

Discussion

Palladium is a silvery-white metal that is commonly used in jewellery and dental restorations, electronics, surgical instruments, spark plugs, and catalytic converters. According to epidemiological data, delayed contact allergy to palladium is common, and is mainly seen together with allergy to nickel, with which it commonly cross-reacts (1). Immediate allergy to palladium compounds confirmed by skin prick testing has been reported in a patient diagnosed with occupational asthma and rhinoconjunctivitis caused by palladium (2). This patient was skin prick test-positive to tetraaminepalladium(II) chloride [Pd(NH₃)₄Cl₂] tested at 0.001%. There are also reports of asthma and chronic urticaria associated with palladium in recently installed dental alloys, although without skin prick testing with palladium (3, 4). Regarding other metals, platinum has been reported to cause immediate allergy and occupational asthma in workers in metal refineries and the catalyst industry (5, 6), and iridium has been reported to cause occupational contact urticaria (7). In addition, nickel has been reported to cause contact urticaria, rhinitis, and occupational asthma (8). This is the first report of occupational allergic rhinitis caused by palladium salts confirmed by nasal provocation testing. Although immediate allergy to palladium appears to be rare, it is a possible cause of occupational contact urticaria and occupational rhinitis in workers exposed to palladium salts.

References

- 1 Faurschou A, Menné T, Johansen J D, Thyssen J P. Metal allergen of the 21st century – a review on exposure, epidemiology and clinical manifestations of palladium allergy. *Contact Dermatitis* 2011; **64**: 185–195.
- 2 Daenen M, Rogiers Ph, Van de Walle C, Rochette F, Demedts M, Nemery B. Occupational asthma caused by palladium. *Eur Respir J* 1999; **13**: 213–216.
- 3 Fernandez-Redondo V, Gomez-Centeno P, Toribio J. Chronic urticaria from a dental bridge. *Contact Dermatitis* 1998; **38**: 178–179.
- 4 Yoshida S, Sakamoto H, Mikami H, Onuma K, Shoji T, Nakagawa H, Hasegawa H, Amayasu H. Palladium allergy exacerbating bronchial asthma. *J Allergy Clin Immunol* 1999; **103**: 1211–1212.
- 5 Baker D B, Gann P H, Brooks M D, Gallagher J, Bernstein I L. Cross-sectional study of platinum salts sensitization among precious metals refinery workers. *Am J Ind Med* 1990; **18**: 653–664.
- 6 Cristaudo A, Sera F, Severino V, De Rocco M, Di Lella E, Picardo M. Occupational hypersensitivity to metal salts, including platinum, in the secondary industry. *Allergy* 2005; **60**: 159–164.
- 7 Bergman A, Svedberg U, Nilsson E. Contact urticaria with anaphylactic reactions caused by occupational exposure to iridium salt. *Contact Dermatitis* 1995; **32**: 14–17.
- 8 Estlander T, Kanerva L, Tupasela O, Keskinen H, Jolanki R. Immediate and delayed allergy to nickel with contact urticaria, rhinitis, asthma and contact dermatitis. *Clin Exp Allergy* 1993; **23**: 306–310.