

MANAGING A SUSPECTED ALLERGY TO LABORATORY RATS AND MICE IN CLINICAL ROUTINE A CASE REPORT

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Abbreviations

IgE: Immunoglobulin E

RLW: Research laboratory worker

RMUP: Rat and mouse urinary proteins

SPT: Skin prick tests

Background

Exposure to mouse and rat allergens can occur through direct contact or through inhalation of aeroallergens from the animal. Repeated and prolonged contact in sensitized subjects may lead to allergy symptoms [1]. People allergic to rats and mice can be sensitized to one or several allergenic proteins from the animal's epithelium, saliva, urine or blood [2].

Case presentation

We report the case of a 29-year-old man who developed rhinoconjunctivitis upon contact with rats and mice for 2 years. He was a research laboratory worker (RLW) and worked at the animal facility daily. He had no atopic dermatitis, no asthma, and no previous rhinoconjunctivitis. He had no treatment. Skin prick tests (SPT) were carried out with commercial extracts of cat, dog, *Dermatophagoides pteronyssinus* (ALK, Puteaux, France), and rat and mouse hair provided by the patient from the animal facility (Fig. 1). The histamine control was positive at 7 mm and the physiological saline control was negative. A positive result was defined as a wheal ≥ 3 mm diameter after 20 min of application [3]. Rat hair was positive at 5 mm (Fig. 1). The other SPT were negative.

The assessment was completed by the determination of specific IgE for epithelium and urine of rats, mice and rabbits using Thermo Fisher Scientific immunoCAP™ (Phadia AB, Uppsala, Sweden) specific IgE tests. Specific IgE to rodent blood serum proteins were also analyzed, as serum albumin can be found in rodent urine and is a frequent allergenic source in RLW [1]. Specific IgE for rodent saliva were not collected, as unavailable routinely. Specific IgE were positive if ≥ 0.10 kUA/L. Specific IgE for rat and mouse urinary proteins (RMUP) were positive at 1.62 kUA/L and 4.97 kUA/L, respectively. Specific IgE for mouse epithelium were weakly positive at 0.31 kUA/L. The other specific IgE were negative (Table 1). Spirometry did not show any obstructive ventilatory disorder.

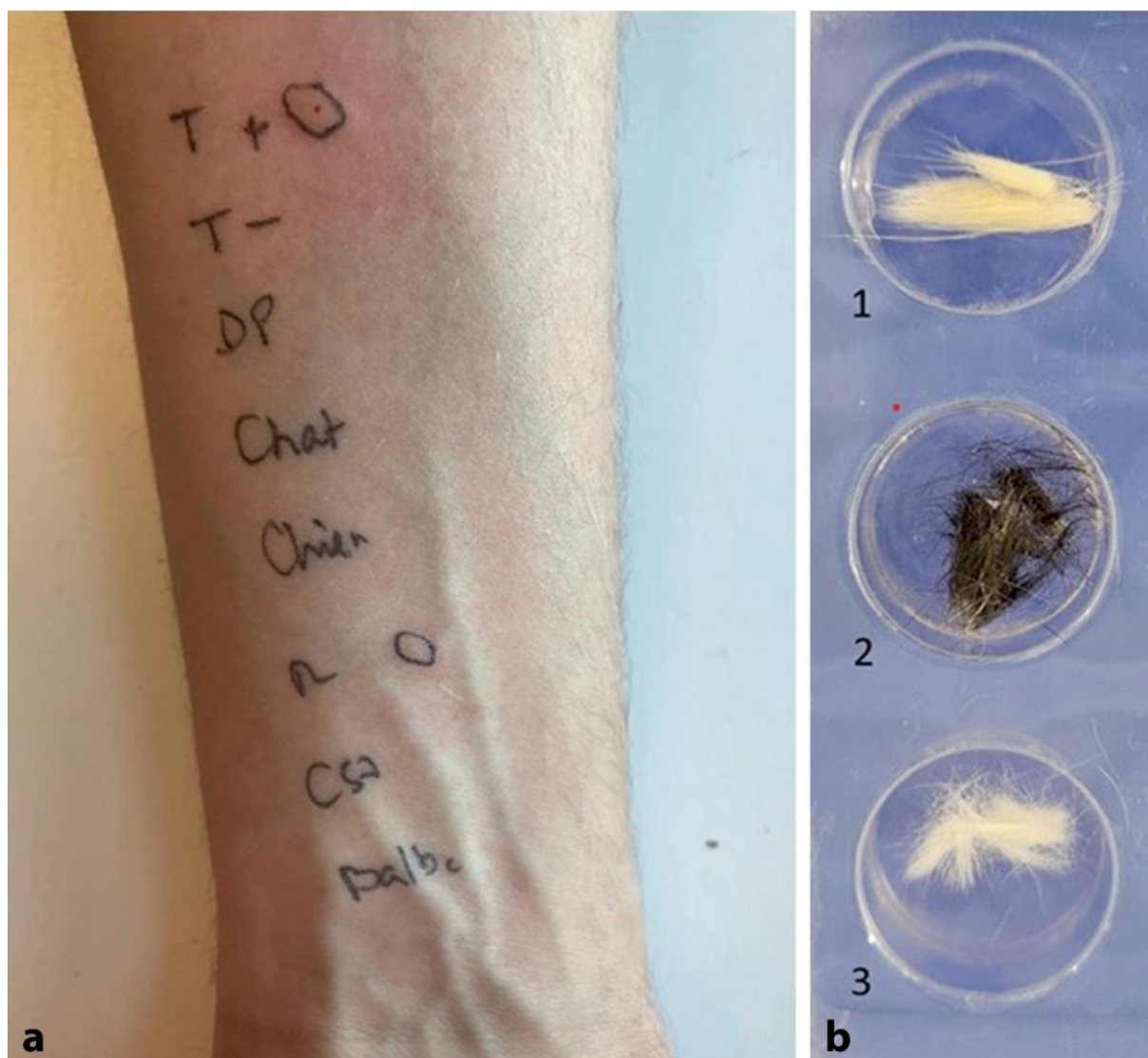


Fig. 1. a Skin prick tests (SPT, 20 min reading): positivity at 5 mm for Wistar rat hair (R). The histamine control (T+) was positive at 7 mm and the physiological saline control (T-) was negative. The other SPT were negative: mouse hair (C57 and BALB/c), as well as cat (Chat), dog (Chien), *Dermatophagoides pteronyssinus* (DP). **b** Rodent hair used for skin testing. 1: Wistar rat hair, 2: C57BL/6 mouse hair, 3: BALB/c mouse hair

Table 1. Patient's allergy assessment: specific IgE for rat, mouse, and rabbit

Specific IgE		Results (kUA/L)
Rat	Urinary proteins	1.62
	Epithelial proteins	<0.10
	Serum proteins	<0.10
Mouse	Urinary proteins	4.97
	Epithelial proteins	0.31
	Serum proteins	<0.10
Rabbit	Urinary proteins	<0.10
	Epithelial proteins	<0.10
	Serum proteins	<0.10

Conclusion

We retained the diagnosis of allergic rhinoconjunctivitis to rats and mice, due to a concordant history and positive specific IgE to rat and mouse urinary proteins (RMUP). The prevalence of rat and mouse allergy in RLW is unknown. In certain series, it can reach 28% of RLW [1]. Allergy to RMUP appears to develop within the first 3 years of laboratory work [1]. The most common manifestations are rhinoconjunctivitis, asthma, and urticaria [1, 4]. Our patient had dual sensitization to rat and mouse urine. The identification of the proteins involved in our patient's allergy has not been investigated, as no tests are routinely available. However, it is known that RMUP both belong to the lipocalin group of proteins [5]. IgE cross-reactivity had been demonstrated between RMUP using RAST (Radio Allergo Sorbent Test) inhibition tests and share 66% sequence homology [2, 5]. The skin prick test of the rat hair brought by the patient was positive and the one of the mouse was negative. According to the allergy work-up, this result could be explained by the contamination of rat hair with urine. However, this remains to be proven. As rat and mouse allergens are not routinely tested for, commercial allergen extracts are difficult to obtain. Therefore, we decided to carry out prick tests with the animal hair brought in. However, for hygiene reasons, we recommend using commercial extracts wherever possible. Determination of specific IgE against the different allergenic sources of rats and mice is easy to carry out routinely. Commercial microarray tests currently detect only few allergenic proteins from rats and mice [6].

This clinical case shows how to carry out investigations in clinical routine in the event of suspected allergy to rats and mice in RLW. Thanks to the specific IgE currently available, it is now possible to precisely detect many protein sources involved in allergy to rats and mice: urinary, epithelial, or blood serum. In the future, it would be interesting to develop routine dosages of specific IgE for

rodent saliva and allergenic recombinants, and to carry out larger-scale epidemiological studies to improve prevention.

Author Contribution

JC was the major contributor in writing the manuscript. AV, FL, PRB, and CDS took part in the writing of the manuscript. All authors read and approved of the final manuscript.

Conflict of interest

J. Caron, A. Vrancken, F. Libon, P. Rannaud-Bartaire and C. Delebarre-Sauvage declare that they have no competing interests.

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References

1. Kang S-Y, Won H-K, Park S-Y, Lee SM, Lee SP. Prevalence and diagnostic values of laboratory animal allergy among research personnel. *Asian Pac J Allergy Immunol.* 2021; <https://doi.org/10.12932/AP-220321-1094>.
2. Jeal H, Harris J, Draper A, Taylor AN, Cullinan P, Jones M. Dual sensitization to rat and mouse urinary allergens reflects cross-reactive molecules rather than atopy. *Allergy.* 2009;64:855–61.
3. Heinzerling L, Mari A, Bergmann K-C, Bresciani M, Burbach G, Darsow U, et al. The skin prick test—European standards. *Clin Transl Allergy.* 2013;3:3.
4. Simoneti CS, Ferraz E, deMenezes MB, Bagatin E, Arruda LK, Vianna EO. Allergic sensitization to laboratory animals is more associated with asthma, rhinitis, and skin symptoms than sensitization to common allergens. *Clin Exp Allergy J Br Soc Allergy Clin Immunol.* 2017;47:1436–44.
5. Jones M. Cross reactivity between rat and mouse urinary allergens. *J Allergy Clin Immunol.* 2004;113:S298.
6. D'Ovidio Wirz Zennaro Massari Melis Peri CMADSPMV, et al. Biological occupational allergy: Protein microarray for the study of laboratory animal allergy (LAA). *AIMSPH.* 2018;5:352:65d.