

## Short communication

# Resolution of peanut allergy following bone marrow transplantation for primary immunodeficiency

Peanut allergy is a severe and life-threatening form of food allergy. Treatments are being developed but the mainstays of current management remain avoidance of peanut and appropriate use of rescue medication. We report the case of a boy with peanut allergy who required a bone marrow transplant (BMT) for combined immunodeficiency. A food challenge, 2 years after transplant, showed that his peanut allergy had resolved. Allergic disorders constitute a form of immune deviation and while we do not advocate BMT as a treatment for peanut allergy, we believe this case provides an insight into the basic mechanisms involved in food allergy.

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The prevalence of food allergy is receiving increasing medical and regulatory attention (1). Sensitization to peanut is increasing, currently standing at 3.3% of 3–4-year-old children in the UK (2) and clinical peanut allergy now affects more than 1% of Canadian children (3). Treatments are being developed but the mainstays of current management remain avoidance of peanut and appropriate use of rescue medication. Bone marrow transplant (BMT) and liver transplant have transferred peanut allergy from the donor to a previously unsensitized recipient (4, 5). We report apparently the first case where the converse occurred: resolution of peanut allergy following BMT.

## Case report

A 12-year-old boy had a history of atopic eczema from 6 weeks of age. By 1 year of age he had suffered urticaria, angioedema and wheeze after eating peas and lentils and by 2 years had had a similar reaction after exposure to peanut. The total immunoglobulin E (IgE) level at 2 years was 5820 IU/ml. Specific IgE measured by radioallergen sorbent test (RAST) showed sensitization to cow's milk class 3 (RAST class 3 = specific IgE = 3.5–17.5 KU<sub>A</sub>/l) and peanut class 4 (RAST class 4 = specific IgE > 17.5 KU<sub>A</sub>/l). Absolute levels of specific IgE at these times are not available for the patient reported. His eczema and

other food allergies had resolved by 5 years of age and his asthma was minimal by the time of transplant. Aged 7 years, the last measurements before transplant showed a level of total IgE of 2533 IU/ml and peanut-specific IgE was 23.1 KU<sub>A</sub>/l, still RAST grade 4.

From the age of 2 years he suffered significant infections. At 6 years, he developed pneumocystis carinii pneumonia and a diagnosis was made of combined immunodeficiency, of unknown molecular basis. His clinical history and pretransplant immunological investigation have been reported previously (6). At the age of 10 years, he underwent BMT from an unrelated male donor of unknown atopic status who was a 1 CW locus mismatch. Nonmyeloablative conditioning involved fludarabine/melphalan/antithymocyte globulin (ATG).

The patient is now 2 years post-BMT. He remains 100% engrafted in both myeloid and lymphoid lineages with normal lymphocyte number, distribution and proliferative response to phytohaemagglutinin (PHA). His IgG and IgM production are normal: IgG 7.27 g/l (5.5–16.1), IgM 0.67 g/l (0.5–1.9) but IgA is slightly low at 0.38 g/l (0.8–2.8). He has made good specific antibody responses to tetanus and haemophilus influenzae type B (HIB) immunization but has not yet received polio immunization. Two months post-BMT his total IgE had fallen to 100 IU/ml. At 17 months post-BMT total IgE was 40 IU/ml and specific IgE to peanut was found to be undetectable (<0.35 KU<sub>A</sub>/l). Skin prick testing

(SPT) was negative for peanut. A peanut challenge was performed and found to be negative to a top discrete dose of 8 g peanut, confirming resolution of peanut allergy. He remains tolerant of peanut, regularly consuming peanut and peanut butter without problems.

## Discussion

This boy with peanut allergy and other food allergies became tolerant to peanut only after BMT for primary immunodeficiency. The loss of peanut sensitization in our patient is in keeping with a previous prospective study looking at skin sensitivity to inhaled allergens before and after BMT (4) and with a report of latex allergy being cured by BMT (7). We think other explanations for his acquired tolerance of peanut are unlikely: his age at transplantation would predict persistence of peanut allergy; most cases of resolution of peanut allergy have been reported in younger children and his high levels of peanut-specific IgE pretransplant suggest he would not have passed a food challenge at the time (8–10). Our patient had been off all immunosuppressive medication for at least 9 months prior to the peanut challenge. Although chronic graft-*vs*-host disease (GvHD) has been shown to impair antibody production and inhibit the response to neoantigens, the absence of GvHD in our patient means that this cannot explain the findings. He demonstrated good responses to immunization

post-transplant, suggesting good T- and B-cell function; immune dysregulation or suppression post-transplant do not appear to account for his acquired tolerance of peanut.

The loss of peanut sensitization following BMT in this patient and the transfer of peanut allergy after BMT and liver transplantation (4, 5) implies that the defect resulting in abnormal IgE production in response to peanut and the basis of T-cell memory lie within the haemopoietic stem cells. The fact that the recipient in this case showed 100% donor engraftment may be important. It is possible that partial donor chimaerism might allow the recipient's allergen-specific T- and B-cell population to remain in sufficient numbers to continue to mount an abnormal allergic response. It is interesting that hyper IgE syndrome – a congenital immunodeficiency characterized by markedly raised serum IgE levels and susceptibility to staphylococcal infections is apparently not corrected by BMT (11), suggesting that the underlying defect in this condition may lie outside the bone marrow haemopoietic stem cell.

It is perhaps not surprising that food allergy can be ablated by BMT but we believe this to be the first reported case, albeit incidental to the primary disease and therapy being addressed in this boy. Allergic disorders constitute a form of immune deviation and while we do not advocate BMT as a treatment for peanut allergy, we believe this case provides an insight into the basic mechanisms involved in food allergy.

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