

BRIEF COMMUNICATION

Paediatric oral peanut challenges: a comparison of practice in London and Western Switzerland

S. Ludman¹, J. Wassenberg¹, G. Du Toit², A. T. Fox², G. Lack² & P. A. Eigenmann³

¹Allergy, Immunology and Rheumatology Unit, University Hospital, Lausanne, Switzerland; ²Children's Allergy Service, St Thomas' Hospital, London, UK; ³Paediatric Allergy Unit, University Hospitals, Geneva, Switzerland

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Correspondence

Dr. Philippe Eigenmann, Medecin adjoint, Paediatric Allergy Unit, Hopitaux Universitaires de Genève, Genève, Switzerland.
Tel.: +41-22-382 45 31
Fax: +41-22-382 47 79
E-mail: philippe.eigenmann@hcuge.ch

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Abstract

Background: There are guidelines on how to develop a food challenge protocol, but at present there is no gold standard guidance on method, and separate units produce differing protocols.

Methods: We performed a retrospective analysis of 200 patients' data from the paediatric allergy units in Lausanne and Geneva, Western Switzerland, and St Thomas' Hospital (STH), UK.

Results: St Thomas' Hospital has a younger cohort with a lower overall mean sIgE (2.36 kU/l vs 8.00 kU/l, $P = 0.004$). The target peanut protein volumes differed: Switzerland 4.4 g vs STH 8.4 g. Despite this, the dose actually achieved in positive challenges was not significantly different (2.33 g vs 1.49 g, $P = 0.16$). 26% of challenges reacted at 4 g or more of peanut protein.

Conclusions: The differences in results highlight how the variation in reasoning behind food challenge alters the outcome. Standardization of food challenges would allow easy comparison between hospitals and geographical areas for research purposes.

Peanut-allergic children in separate geographical areas have different clinical and immunological characteristics probably as a result of different dietary habits (1), environmental pollutants, racial and socioeconomic differences (2). Despite the important advances in the technology of allergy testing, oral food challenge remains the gold standard diagnostic tool. An EAACI position paper (3) gives the standard indications for food challenges, and a number of papers discuss the methodology and requirements for conducting them (4–9), but at present there is no definitively agreed protocol for the conduct of food challenges (FC).

This study is a retrospective descriptive comparison study and database analysis between two paediatric populations: England and Western Switzerland. Different centres often use data gained from testing and challenging in different European/worldwide centres and generalize this to their own practice. Without standardizing practice and methodologies, there is a risk that such generalization will be inappropriate.

Methods

The food challenge databases in Lausanne (CHUV), Geneva (HUG) and St Thomas' (STH) Paediatric Allergy units were

used to identify the last 100 consecutive patients to undergo a peanut FC. Patients were included if they were under the age of 18, had no history of recent anaphylaxis to peanut, were children with sensitization or proven allergy, and only the active sample in a blinded challenge. All data were taken from existing databases. Lausanne and Geneva unified their practice prior to the first FC, and treat a similar referral population allowing them to be considered as one study centre. Ethical approval was given by the local ethical committees.

Data analysis was performed using PASW version 18 (SPSS Inc., Chicago, IL, USA) using Student's *t* test for parametric data and chi-square test for nonparametric data.

Results

Of the 444 total food challenges performed by STH from July 2010 to July 2011, the 100 peanut FC comprised 22.5% of the FC. The Swiss data are from May 2010 to August 2011. HUG performed 174 food challenges in total, the peanut food challenges making up 29.9% of those. CHUV performed 217 food challenges, and the 48 peanut FC comprised 22.1%. Table 1 shows general patient characteristics and key values of the positive food challenges. Table 2

Table 1 Characteristics of all peanut challenges and comparison of key positive data

Patient characteristics of all peanut food challenges					
	Total	St Thomas	Switzerland	<i>P</i> value	
Food challenges	200	100	100	–	
Male	121	61	60	1.000	
Age (years ± SD)	6.85	5.9 ± 4.2 (0.7 – 16.7)	7.8 ± 3.5 (2.35–16.5)	0.007	
Positive FC	73	25	48	0.001	
Negative FC	117	69	48	–	
Inconclusive	10	6	4	0.748	
Positive FC with medication	35	12	23	0.995	
Adrenaline	2	1	1	1.000	
Other food allergy	139	87	52	0.001	
Eczema	94	57	37	0.007	
Asthma	54	17	37	0.002	
Key values of positive food challenges					
	Centre	Number (N)	Mean	Standard deviation	<i>P</i> value
Age at challenge (years)	1	25	5.8	4.1	0.006
	2	48	8.4	3.5	
Cumulative peanut protein ingested(g)	1	27	2.3	3.3	0.160
	2	48	1.5	1.8	
Specific IgE (kU/L)	1	17	0.5	0.6	0.022
	2	43	12.3	20.0	

Centre 1 = St Thomas' Hospital; Centre 2 = Combined Swiss hospitals.

Table 2 Summary of protocols for peanut challenges in London and Switzerland

	Peanut product	Cumulative challenge doses in grams (Peanut protein doses in grams)						Cumulative dose (g)	Maximum protein dose(g)
St Thomas	Whole peanut	Buccal smear	0.5 (0.1)	2 (0.5)	4 (1.0)	10 (2.6)	15 (3.9)	31.5	8.19
St Thomas	Peanut butter	Buccal smear	0.6	2.3	4.5	11	17	35.4	9.2
St Thomas	Bamba	Buccal smear	0.85 (0.1)	2.13 (0.3)	4.25 (0.5)	8.5 (1.0)	34 (4.1)	66.73	8.0
Switzerland	Peanut protein	–	0.03	0.1	0.3	1	3	4.43	4.43

lays out the challenge protocols; STH uses Bamba (a peanut-based snack) in young children, peanut butter or whole peanuts at patient request in older children. The Swiss centres use peanut flour or peanut butter in a cookie, or whole peanuts as per patient choice. All protocols use peanut protein as absolute values and convert to the relevant peanut product, ensuring the same amount of peanut protein in each dose.

Similarities in practice include nurse-led FC, with a doctor and full resuscitation equipment available in the event of anaphylaxis. Patients are given increasing doses after 20 min and remain in hospital for 2 h after the challenge. In the event of an equivocal reaction, the same dose is repeated to assess tolerance or induce an unequivocal reaction. Baseline investigations (peak flow, blood pressure and temperature) are recorded, and an intravenous cannula is not inserted. All take written consent, but do not use a written guideline for the termination of a positive FC. HUG performs blinded challenges for older children if necessary.

The cumulative volume of peanut protein in Swiss challenges is 4.43 g and is 8.19 g in London. St Thomas' Hospital starts the FC with a labial challenge.

Of the 200 FC (100 per cent), 73 were positive (25 in London and 48 in Switzerland). 35 positive FC were given medication (12 in London and 23 in Switzerland). Most reactions occur at low doses: average protein dose ingested in London was 2.3 g $\pm$ 3.3, compared to 1.5 g $\pm$ 1.8 in Switzerland ($P = 0.160$). Five patients reacted at the highest dose of 8.19 g in London (11 patients reacting at 4 g or above), and eight patients at 4.43 g in Switzerland (Table 1). Seven of ten STH challenges terminated at the lip challenge dose, due to hives around the mouth, had atopic dermatitis.

The groups were significantly different in ages: STH 5.9 $\pm$ 4.2 years (0.7–16.7 years) and Switzerland 7.8 $\pm$ 3.5 years (2.35–16.5 years) ($P = 0.001$). The sIgE results obtained in London were significantly lower than in Switzerland: 0.5 kU/L vs 12.3 kU/L ($P = 0.022$). Only one sIgE in London was above the 95% predictive cut-off point of 15 kU/L, and seven in Switzerland with similar criteria in the three centres based on clinical history combined with skin prick tests. St Thomas' Hospital performs a larger proportion of their food challenges on young children who have other food allergies

and are found to be sensitized to peanut. Hence, their mean age and, concurrently, their sIgE are lower. Western Switzerland tends to perform FC on patients who have presented with a history of peanut allergy, and the FC is used to assess whether or not tolerance has been achieved.

Discussion

Our retrospective analysis of the conduct and outcome of food challenges to peanut between two different European regions highlights several interesting similarities and differences in practice.

The labial challenge is no longer used in Western Switzerland as they found anecdotally that if the child reacted on contact, continuing the challenge often produced a negative FC (6). London uses it to give a 'trace' amount of peanut protein (3, 7). An initial dose of 0.03 g of peanut protein (as per the Swiss group) could be a standardized method of giving a trace amount. Clinicians must exert judgement on the risk of the FC such as recent anaphylaxis or possible FPIES and the need for IV cannulae; however, none of the centres routinely inserted one.

The regime suggested by EAACI (3) recommends a cumulative dose of 9.3 g of peanut protein, which is similar to the American Working group (7). EuroPrevall suggests semi-logarithmic increases from 3 µg to 3 g (10) of protein, on which the Swiss teams have based their protocol. The similarity of reaction severity in both groups suggests that the higher doses do not increase the severity of reactions. We can see from our data that 19/73 (26%) children reacted at or above 4 g of peanut protein. This raises the possibility that judging a FC negative at a low cumulative dose will raise the false-negative testing rate and should be considered in future guidelines.

In the Swiss group of patients, an expected positive FC rate of 50% is quoted as achieving the optimal risk-to-benefit ratio of having a challenge (7, 11, 12) and the centre's patient risk stratification is weighted to aim for this. London aims to introduce nuts in patients who are sensitized but have not

eaten nuts. This highlights the two main indications for peanut FC, and the variation seen in the rate of positive results between these two centres.

In conclusion, the method of challenging children to peanuts between large University Hospital settings in London and Switzerland is broadly similar, but with differences in volumes of peanut and the use of a labial challenge and the weighting of the indication for testing.

Departments performing FC need to balance the risks of a positive FC against the benefit of introducing peanut into their diet at an earlier stage, as well as the benefit of correct diagnosis in a sensitized patient and clarifying dietary advice given.

We suggest removing the labial challenge from the protocol. Low final cumulative doses of peanut protein may leave units open to false-negative results. Standardization of protocols for research will aid comparison of the wealth of data being collected and can only help in future investigation into geographical variation and epidemiology of challenges; however, the allergy clinician can always consider adapting the food challenge protocol depending on specific patient characteristics.

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Authors' contributions

SL was involved in the initial concept and data collection, and is a primary author of the manuscript. JW was involved in the review of data and manuscript. GL and ATF were involved in the review of the manuscript. GdT and PAE were involved in the initial concept and review of the manuscript.

Conflict of interest

None of the authors has any conflicts of interest to declare with respect to this manuscript.

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