Case Report

NOVEL CROSS-REACTIVITY SYNDROME: SEVERE ALLERGY TO INGESTED QUORN (MYCOPROTEIN) IN A MOULD-ALLERGIC ADOLESCENT

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SUMMARY
Cross-reactivities between aeroallergens and certain food allergens have long been recognised. The classical pattern is one of initial sensitisation to an inhalant allergen followed – usually years to decades later – by the development of a secondary food allergy, owing to shared common proteins such as the PR-10 proteins, profilins and lipid transfer proteins.[1] The most common aeroallergen–food allergen cross-reactivity syndrome is the pollen–food ('oral allergy') syndrome; this involves prior sensitisation to pollens (grass, weed or tree) and the later development of food allergy to certain fruits, vegetables and nuts. Prior sensitisation to natural rubber latex can also lead to the latex–fruit syndrome, in which the shared enzyme chitinase leads to cross-reactivity between latex products and certain tropical fruits. Rarer forms of aeroallergen–food allergen cross-reactivity include the 'cat–pork' syndrome (allergy to pork following a cat allergy, owing to a cross-reactive serum albumin) and the 'bird–egg' syndrome (a cross-sensitisation between bird allergens and egg yolk). Sporadic cases of the 'mould–mushroom' syndrome have also been described[2] in which patients with mould-spore hypersensitivity react to mushrooms, usually in their raw form. In this case report, we report on a South African schoolboy, known to be allergic to inhaled mould spores, who reacts with anaphylaxis to an ingested meat substitute containing mycoprotein ('mould protein'). The case illustrates the potential for novel cross-reactivity syndromes to develop as novel plant-derived 'meat-substitute' food allergens become more widely available and in vogue.

Keywords: Novel cross-reactivity syndrome; quorn; mycoprotein; mould-allergic adolescent

CASE DESCRIPTION

We describe the case of a 16-year-old boy, generally well and fit and an avid rugby player. He had mild persistent asthma, well controlled on an inhaled corticosteroid (ICS)/long-acting β2-agonist (LABA) combination. In addition, he had a longstanding history of allergic rhinitis (AR), well controlled on an intranasal corticosteroid. Four years previously, he had undergone aeroallergen skin-prick testing (SPT), and the results had come up positive to Alternaria mould (4 mm) and Cladosporium mould (4 mm).

He had never experienced any problems when eating mushrooms, and a few weeks prior to presentation he had tasted a small sample of a 'Quorn' burger patty (made of a fungal-derived mycoprotein) with no ill-effects.

This 16-year-old boy presented to an emergency unit in Cape Town 60 minutes after ingesting four Quorn burger patties, which he had ingested as a high-protein healthy snack before a rugby training session. He had also ingested cashew nuts that same

Figure 1: Quorn mince, packaged, and also prepared by frying

afternoon. About 20 minutes after ingesting the Quorn patties, he had started his rugby training session, and within minutes of exercising felt an itchy throat, developed an urticarial rash on the face and trunk, and then started clearing his throat persistently, feeling faint and confused. The coach called an ambulance and within a few minutes he was taken to the nearest ER, where he was treated immediately with intramuscular adrenaline and antihistamines. He settled well and was kept in hospital overnight for observation.

He presented to our allergy centre a few weeks after this episode for further investigations. He examined well, with a clear chest and normal lung-function tests. In anticipation of the appointment, we had purchased Quorn mince from a local shop, and prepared some Quorn protein both in the form of 'cooked mince' and as 'raw mince' for SPTs (see Figure 1).

TABLE I: SKIN-PRICK TEST RESULTS (SEE FIGURE 2)

Cashew nut	0 mm
Alternaria mould	3 mm
Cladosporium mould	3 mm
Aspergillus mould	1 mm
Quorn mince (cooked)	4 mm
Quorn mince (raw)	5 mm (performed twice)
Positive control	3 mm
Negative control	0 mm

Figure 2: Skin-prick tests to Quorn mince

A diagnosis of anaphylaxis to ingested mycoprotein was made, following a longstanding allergy to inhaled mould spores. Confounding factors for the anaphylaxis were the large amount of mycoprotein consumed and the intensive exercise which followed ingestion.

DISCUSSION

Quorn products are meat-free substitutes with a spongy, tofu-like texture, made almost entirely out of mycoprotein. Mycoprotein is a fungal protein derived from the fungus *Fusarium venenatum* and is grown by fermentation in vats (similar to the fermentation process of beer). The product originated in the United Kingdom, but is now available in more than 20 countries (including South Africa) in the form of mince, sausages and patties. Mycoprotein has been hailed as the 'future of nutritious non-meat protein'.

Over many years of use from the late-1990s, isolated case reports have been published describing reactions to Quorn, chiefly in those suffering from a mould-spore allergy.[3–5] In 2018, Jacobson et al described a case series in which self-reported adverse events were collected via a website www.quorncomplaints.org.[6] Based on this particular web-based questionnaire, more than 1 700 adverse events were reported after eating Quorn products. The pattern of reactivity consisted of immediate-type allergic symptoms (fatal in one case in this series) and also a second later peak, with delayed gastrointestinal symptoms.

In 2017, the makers of the meat substitute, Quorn, changed their labelling to highlight its main ingredient of mould, with a warning of a small risk of an allergic reaction to Quorn in patients suffering from a mould allergy. Although this change in labelling is obligatory in the United States, it is not yet universal.

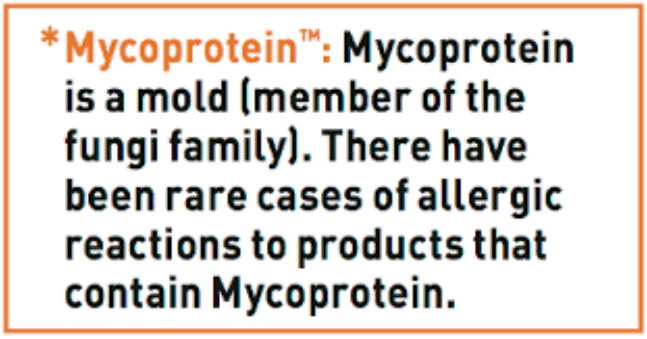

Figure 3: US labelling requirements for Quorn (source www.foodsafetynews.com)

CONCLUSION

This case report highlights the potential for aeroallergen–food allergen cross-reactivity with potentially severe reactions, in this case to a food allergen rather 'new' to South Africa.

Aeroallergen–food allergen cross-reactivity syndromes are likely to become more common in future years in view of:

- a general increase in aeroallergen sensitisation, often from an early age;
- more intensive pollen seasons and mould-spore peaks concomitant with global warming trends;
- greater use of 'novel' food allergens in line with dietary trends such as meat-free diets.

The biggest challenge with potential cross-reactivity syndromes is in differentiating between non-pathological, incidental cross-reactivity that leads to false-positive food-allergy results and true symptomatic food allergies. An excellent and thorough history remains key. Component testing, including micro-array testing in complex cases, may be called for.

Physicians need to familiarise themselves with the typical features and prognosis of each aeroallergen–food allergy cross-reactivity syndrome in order to be able to counsel patients appropriately. For example, many cases of pollen–food syndrome produce mild localised oropharyngeal reactions, whereas as cross-reactivity involving lipid transfer protein (LTP) molecules may more frequently lead to severe reactions.

As the scope of novel foods widens in response to both health trends and genetic modification, physicians will need to be on the look-out for reactions to novel allergens.

DECLARATION OF CONFLICT OF INTERESTS
The author declares no conflict of interests.

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