

CASE REPORT

Sensitization to king scallop (*Pecten maximus*) and queen scallop (*Chlamys opercularis*) proteins

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Objective	To report a case of occupational asthma and urticaria due to the queen scallop (<i>Chlamys opercularis</i>) and king scallop (<i>Pecten maximus</i>).
Background	A 40-year-old female worked in a shellfish-processing plant, handling king and queen scallops for 5 years. At the time of investigation, she described a 2-year history of work-related respiratory symptoms.
Methods	Serial peak expiratory flow rate readings were recorded and an OASYS study completed. A workplace visit was undertaken and specific immunoglobulin (IgE) radioallergosorbent (RAST) testing of scallop extracts was performed.
Results	The OASYS study was consistent with occupational asthma. RAST testing demonstrated evidence of specific sensitization (IgE) to queen and king scallop. There was also some cross-reactivity observed with other shellfish (prawns and crabs).
Conclusion	Workers exposed to aerosols from scallop species are at risk of occupational asthma and require effective respiratory health surveillance.
Key words	IgE; occupational asthma; scallops; sensitization; shellfish.

Introduction

Occupational hypersensitivity reactions to seafood have been reported in workers involved in every stage of seafood processing and delivery and are associated with all the major seafood groupings [1]. The Health & Safety Executive has previously investigated asthma caused by scampi, crab, trout and salmon, but although occupational asthma caused by exposure to scallop (proteins) has been reported [2], it is less extensively described. We report the case of a 40-year-old female scallop processor who developed work-related respiratory symptoms. A visit was made to the workplace to determine if the employee's symptoms could be attributed to the work environment.

Case report

The subject developed respiratory symptoms 3 years after starting work in a small company processing scallops prior to freezing. She also described contact urticaria

on her forearms. There was no prior history of atopy or asthma. Her symptoms were worse at the end of work shifts and eased with time away from the workplace. She was prone to coughing bouts and often had to leave the work area to ease her breathing. Her symptoms were particularly bad when working on half-shell queen scallops, especially with the workroom doors closed. Spirometry demonstrated airflow obstruction and an OASYS study showed evidence of greater variability in peak expiratory flow rates on workdays compared with rest days (Figure 1). The calculated work effect index was 3.83 (positive result >2.5) [3]. She had been commenced on a salbutamol inhaler by her general practitioner with some improvement in symptoms.

The workplace consisted of a small room with some ventilation provided by high-level wall-mounted fans. Six processors worked in this area, with three working on de-shelling and others performing ancillary duties, e.g. box transfers, weighing and unloading of freezers. De-shelling was carried out on an open table in the middle of the room. The scallops were processed in two ways:

- Removal of meat and soft tissues by cutting through tissue connection and scooping. The meat was placed in trays, weighed and washed in colanders.
- Queen scallops were prepared in their shells. These scallops were only half de-shelled. The shells were

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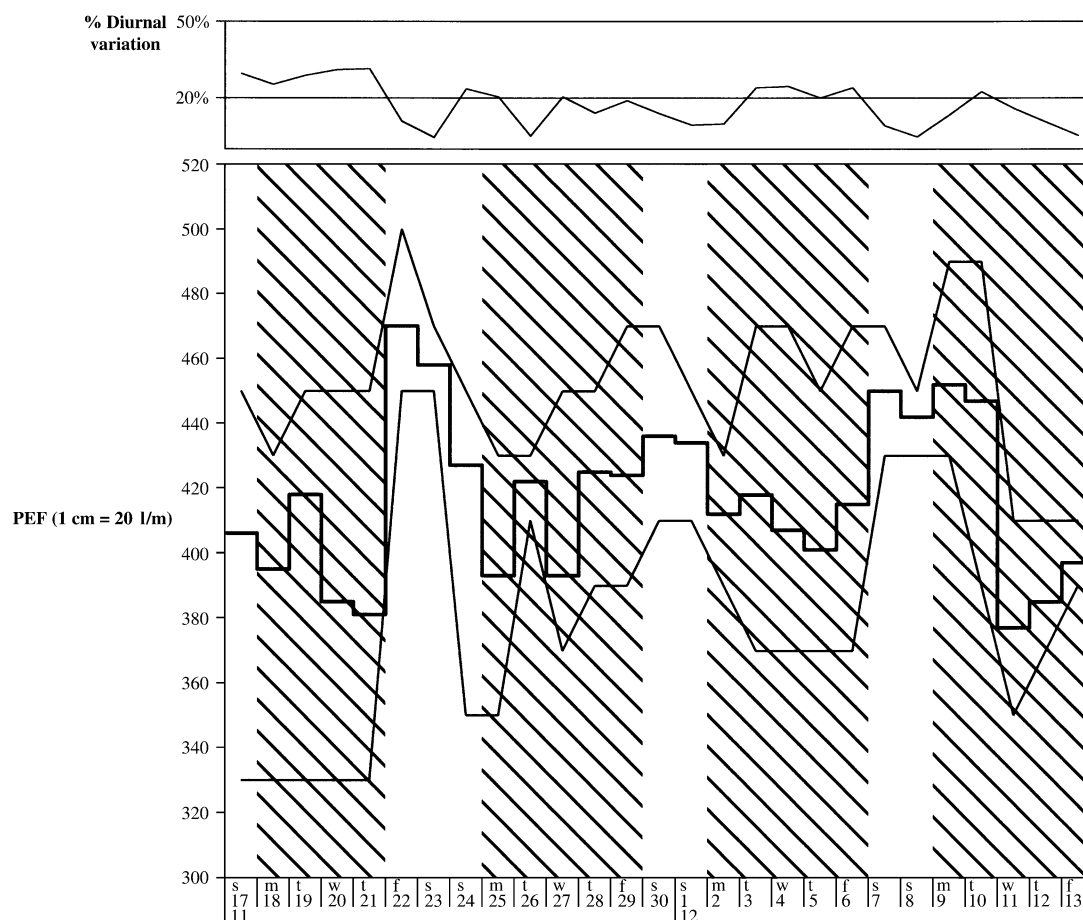


Figure 1. OASYS plot showing serial peak expiratory flow rates with increased diurnal variability on workdays (shaded) compared with rest days.

cleaned on mesh trays using pressurized water sprays to alternatively wash inside and outside of the shells. Power washing removed most of the visible dirt.

Trays and floors were hosed down using a pressurized water hose. The flesh waste was swept into a drain. The cleaning of the queen scallop shells produced a significant aerosol which spread throughout the work area. Observations during the visit indicated that substantial water/protein aerosol was also generated during spray washing of trays, particularly the half-shell queen. Employees felt conditions were unbearable unless the doors were kept open. Simple surgical masks were worn (premier pleated surgical facemasks). Some splashing of mainly larger particles was noted during de-shelling and various cleaning operations which gave rise to the spread of flesh and debris onto tables and clothing. Employees wore white overalls, rubber aprons, mop caps and Wellingtons.

Samples of king scallop (*Pecten maximus*), queen scallop (*Chlamys opercularis*) and scallop viscera were obtained from the workplace. Extracts of these materials were prepared in phosphate-buffered saline and their protein concentrations determined using an automated

dye-binding method (BioRad) using human serum as standard.

Radioallergosorbent (RAST) analysis was performed according to the method described by Ceska *et al.* [4] using extracts of king scallop, queen scallop and scallop viscera conjugated to cyanogen-bromide-activated paper discs (1 mg allergen to 100 mg paper discs). The results were expressed as RAST scores (Table 1).

The proteins of each extract were separated by molecular weight using the sodium dodecylsulfate polyacrylamide gel electrophoresis (SDS-PAGE) technique. Gels were stained with coomassie blue or semi-dry blotted onto nitro-cellulose for immunoblotting with worker's serum [5]. SDS-PAGE indicated that while the queen scallop and scallop viscera extracts had a similar protein pattern, the king scallop extract was substantially different. Some common protein bands were seen, especially in queen scallop and scallop viscera, with proteins of molecular weights ranging from 19 to 42 kD being most predominant. Immunoblotting of these proteins with immunoglobulin (IgE) antibodies from the subject again showed different binding patterns to scallop proteins. In all three extracts, the most intense binding was to proteins of molecular weights 19–42 kD, with this

Table 1. Specific IgE results

Sera	RAST score						
	Mixed environmental allergens ^a	Queen scallop	King scallop	Scallop viscera	Prawn	Prawn washing	Crab
Scallop worker	3.6	90.6	66	55.1	7.5	4.6	3.3
Control 1	28.6	1.2	1.2	1.1	^b	^b	^b
Control 2	1	1.2	1.2	1.3	^b	^b	^b
Control 3	48	1.1	1.1	1.2	^b	^b	^b
Control 4	0.9	1	1.1	1	^b	^b	^b

A RAST score ≥ 2 is considered positive (in bold). Four non-exposed control sera were also analysed: control 3 was an atopic asthmatic.

^aHouse dust mite, cat fur and mixed grasses.

^bNot analysed.

being most intense and widespread to queen scallop extract—reflecting and confirming the validity of the RAST results. The specificity of the binding was also supported by the inability of a control serum from a highly positive atopic asthmatic (atopy RAST score: 48.0) to bind to any of these proteins.

Discussion

Occupational seafood allergy may be manifest as rhinitis, conjunctivitis, asthma, urticaria and contact dermatitis. The reported prevalence of occupational asthma due to seafood varies from 7 to 36%, with higher rates associated with arthropods (crustaceans) than with pisces (bony fish) and molluscs (e.g. scallops) [1]. In the UK, there are over 22 000 employees in the seafood-processing industry, but there have only been 67 actual cases (155 estimated cases) of asthma attributed to ‘crustaceans and fish’ reported to SWORD (Surveillance of Work-related and Occupational Respiratory Disease) since it began in 1989 and only 8 actual cases (96 estimated cases) reported to OPRA (Occupational Physicians Reporting Activity) since 1996 (personal communication). This discrepancy may be due to under-reporting or missed diagnoses.

Our subject had high levels of specific IgE antibodies to extracts prepared from king scallop, queen scallop and scallop viscera obtained from the work site. These results show that this worker was immunologically sensitized to scallops and, in the context of her symptoms and positive OASYS chart, provide strong evidence of occupational asthma caused by scallop exposure.

The subject also had positive RAST scores to crab and prawn, albeit at a much reduced level. It is not clear whether this reflects cross-reactivity or multiple exposures. Cross-reacting antibodies have been described for allergens in taxonomically close species, such as shrimp and scallop [2]. The muscle protein tropomyosin (molecular weight ~ 35 kD) has been implicated as a major allergen in arthropods especially crustacea and to some

extent in molluscs [6] and is likely to be the primary source of the cross-reactivity [7].

The results of this investigation highlight that company risk assessments need to consider potential exposure, both dermal and respiratory to scallop proteins. Control measures such as improved ventilation and/or changes in work practices could have eliminated or reduced the risk considerably [8]. If health surveillance for respiratory sensitizers had been in place, ill-health effects could have been detected at an earlier stage thus preventing the development of occupational asthma.

RAST analysis ($\pm$ inhibition assays) could be used to confirm sensitivity to scallop proteins and support a diagnosis of occupational asthma. In addition, it may be relevant to develop a reliable tropomyosin assay to assist better understanding of allergy in such seafood workers. An investigation of workplace exposure to scallop proteins may be useful as a baseline to judge hygiene improvements against and to provide data on exposure–response relationships.

Conflicts of interest

None declared.

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