

Seafood Allergy: Causes, Prevention Modalities, and Treatment Guidelines in the Indian Scenario

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Abstract

Seafood allergy is a hypersensitivity disorder with growing prevalence. Allergy to shellfish is among the leading cause of food allergy in adults, and the most common cause of food allergic emergency department visits. Seafood allergy is immunologic response to proteins in these foods and include IgE antibody-mediated allergy. Allergies can occur at any age but are common in adults and adolescents than in children. While figures vary from country to country, approximately 1–2% of the adult population and <1% of children are affected. In most patients tolerance develops to food antigens, however, when tolerance fails to develop, hypersensitivity reaction occurs. Food allergy affects up to 8% of the children below 5 years of age and approximately 3.5% in the general population. Adults with shellfish allergies should be aware of how to use this on themselves or their child if child is suspected shellfish allergy. It is also recommended for such individuals to wear medical alert bracelet necklace or carry USB drive so that health care worker can be aware of their condition in emergency. Effective and accurate diagnostic workup is essential for clinicians and patients. This article summarizes about seafood allergy cause, diagnostic approaches, and management in case of life-threatening emergencies.

Key words: Anaphylaxis, IgE, Inj. EpiPen, Parvalbumin, Seafood allergy, Tropomyosin

INTRODUCTION

Seafood allergy is the common food allergy among the most prevalent food allergies in young children and adults.^[1]

The term “seafood” encompasses the following:

- Vertebrate finned fish, such as salmon, tuna, and cod
- Crustaceans, such as shrimp, prawn, crab, lobster, and crawfish
- Mollusks, such as squid, snails, and bivalves.

The term “shellfish,” a subset of seafood, includes crustaceans and mollusks.

Seafood allergy is immunologic response to proteins in these foods^[2-5] and includes IgE antibody-mediated allergy as well as other allergic syndromes. They are distinct from adverse reactions due to toxins or infectious contaminants, which are not immune based.

Allergy to seafood is very common. Allergy to sea food is very common, it is estimated to affect 1-2% of adult population and <1% of children.^[6-9] Allergy to shellfish is among the leading causes of food allergy in adults, and the most common cause of food allergic emergency department visits.^[10]

Adverse food reactions are common and often assumed by patients to be allergic in nature. Food allergies are adverse immune responses toward food proteins.^[6]

Sensitization to food allergens may occur in the gastrointestinal tract considered as traditional or Class 1 food allergy or a consequence of allergic sensitization to inhalant allergens considered as Class 2 food allergies.

Several Class 1 and 2 food allergens have been identified. The variety of animal-related allergens appears to be limited in number and cross-reactivity.

PATHOGENESIS

The major allergic proteins in seafood that are responsible are IgE mediated and non-IgE mediated. Persons with seafood allergy may react to these and/or other seafood proteins.

Parvalbumin is the important allergen in fish.^[11]

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Tropomyosin is major allergens in shellfish and is also present in other arthropods accounting for cross-reactivity between these groups.^[12,13]

In shrimp muscle protein, myosin light chain and sarcoplasmic calcium-binding protein are prominent allergens.^[14,15]

The pathogenesis of non-IgE-mediated seafood allergy is unclear. A syndrome that clinically resembles protein-induced enterocolitis has been described in both children and adults.

CLINICAL FEATURES

Three types of reactions have been recorded.

IgE-mediated Reaction

IgE-mediated allergic reactions are the most commonly described type of allergic reactions to seafood ingestion. These may present as generalized reactions, asthmatic reactions in response to occupational or household exposures, or as food-dependent, exercise-induced anaphylaxis.

IgE-mediated reactions are rapid in onset (usually within minutes to an hour after ingestion) and extra-gastrointestinal manifestations, such as urticaria, angioedema, respiratory symptoms, and laryngeal edema, are common. These can range in severity from mild to life-threatening anaphylaxis; severe reactions are not uncommon.^[16,17]

Occupational and household exposures involving inhalation of cooking or processing vapors may cause asthma and allergy.

Anaphylaxis

Food-dependent, exercise-induced anaphylaxis to seafood has also been reported.^[18] In this condition, the food causes symptoms only if ingestion is followed soon after by exercise or exertion but is tolerated in the absence of exertion. Wheat products and seafood are the two most frequently implicated foods in this disorder.

Severity – IgE-mediated fish and shellfish allergies can vary from mild to severe. In the US prevalence study, 60–70% of respondents experienced urticaria/angioedema, and over one-half reported dyspnea or throat tightness. Consistent with this, approximately one-half of reactions prompted evaluation by a clinician or care in an emergency room.

Non-IgE-mediated Reaction

There are several other reactions to seafood exposure that is not IgE mediated. These include:

Gastrointestinal reactions – food protein-induced enterocolitis^[19] has been described in children in response to fish, although there is a paucity of data on this entity. In the largest series of 14 children diagnosed between the ages of 9 and 12 months of age, symptoms consisted of vomiting, diarrhea, or both. Three presented with a sepsis-like picture. Reactions occurred from a few minutes to 6 h after ingestion. Skin prick tests were negative in all patients, and fish-specific serum IgE was positive in just one patient. Nine had the reactions confirmed by oral challenge. Four of these children eventually became tolerant of the causal food.

Seafood may also cause an enterocolitis-like disorder in adults, with delayed onset of nausea, crampy abdominal pain, and protracted vomiting or diarrhea. This appears to be primarily reported in response to mollusks. Adults typically present after having experienced this on several occasions, reporting that they had attributed the first one or two reactions to possible food poisoning.

The etiology of these enterocolitis-like reactions in adults is unclear. Their repeated occurrence in certain individuals suggests either that some persons are more susceptible to toxic components in these foods or that this reaction represents a form of allergy. There are very few studies of the pathogenesis of these reactions, although one study of adults with isolated gastrointestinal symptoms to various types of seafood included six patients who reacted repeatedly to oyster, in whom specific IgE was generally undetectable.^[20]

Allergic contact dermatitis – allergic contact dermatitis^[21] can result from occupational skin exposure to seafood, in food handlers. Skin barrier disruption has been implicated.

DISCUSSION

All food allergies are caused by an immune system problem. Your immune system identifies certain shellfish proteins as harmful, triggering the production of antibodies to the shellfish protein (allergen). The next time you meet proteins in shellfish, these antibodies recognize them and signal your immune system to release histamine and other chemicals that cause allergy symptoms.

Shellfish/prawns are considered a major cause of food allergic reactions in adults, affecting 4–5% in the Indian population. Variety of seafood has been studied (snail, oysters, prawns, crabs, and lobsters). Shrimp allergens have been extensively studied.

Tropomyosin^[11,12] a protein found in the muscle has been identified as a major allergen in shrimp. Invertebrate

tropomyosin is highly homologous and tends to be allergic to those from the crustaceans (shrimp, prawns, crab, crawfish, and lobster), whereas vertebrate tropomyosin tends to be non-allergic.

Histamine and other body chemicals cause a range of allergic signs and symptoms. Histamine is partly responsible for most allergic responses, including running nose, itchy eyes, dry throat, rashes and hives, nausea, diarrhea, difficulty in breathing, and in some cases, anaphylactic shock.

Some people are allergic to only one type of shellfish but can eat others. However, some people with a shellfish allergy must avoid all varieties of shellfish.

Although people of any age can develop a shellfish allergy, it is most common in adults. Among adults, shellfish allergy is more common in women. Among children, shellfish allergy is more common in boys.

Prawn Allergy

Some of the symptoms of prawn allergy that can occur immediately after eating prawn or after few hours are as follows:

- Hives and rash on skin: Prawn allergy rash can occur all over the body, it is associated with immense itching. It can be due to eating prawns or even meeting a prawn
- Sneezing and watering of eyes
- Cough and breathing difficulty
- Swelling over face and other parts of body.

In severe cases, prawn allergy can lead to anaphylaxis, a dangerous allergic reaction marked by a swollen throat (airway constriction), rapid pulse, shock, and dizziness or light headedness. Anaphylaxis can be life threatening.

When you have prawn allergy, you may be at increased risk of anaphylaxis if:

- You have asthma
- You have allergic reactions to very small amounts of shellfish (extreme sensitivity).

SUMMARY

Ingested food represents foreign antigenic load. In most of the patient's, tolerance develops to food antigens; however, when the tolerance fails to develop the immune system respond with hypersensitivity reaction. Food allergies affect up to 8% children below the age of 5 years. and approximately 3.5% in the general population. Inadvertent ingestion of food allergens may provoke symptoms related to gastrointestinal and respiratory system, dermatological symptoms, anaphylaxis, and shock.

PREVENTION IS BETTER THAN CURE

Mayo Clinic Guidelines

If you know you are allergic to shellfish, the only sure way to avoid an allergic reaction is to avoid all shellfish or products that might contain shellfish. Even trace amounts of shellfish can cause a severe reaction in some people. Shellfish are not usually a hidden food ingredient, so it may be easier to avoid than some other allergy causing foods.

The federal Food Allergen Labeling and Consumer Protection Act requires that any packaged food product that contains shellfish as an ingredient must list the name of the specific shellfish on the label. Please be sure to read all product labels carefully before purchasing and consuming any item. Remember, also, that ingredients change from time to time, so check labels every time you shop. If you are still not sure whether a product contains shellfish, call the manufacturer. Always take extra precaution when dining in restaurants or eating foods prepared by others. If you are ever in doubt about any product or dish, do not eat it.

Measures for Avoiding Shellfish

Be cautious when dining out

Eating at restaurants poses the biggest danger of mistakenly eating shellfish. When you eat at restaurants, always check and make sure the same pan, oil or utensils used for shellfish are not also used to prepare other foods. This is called cross-contamination.

Use extra caution at seafood restaurants

Fish and shellfish are biologically distinct, so fish will not cause an allergic reaction if you have a shellfish allergy – unless you are also allergic to fish. However, when eating at a seafood restaurant, there is a higher risk of cross contamination of your food with trace amounts of shellfish. Some people even have allergic reactions to cooking vapors.

Read labels

Cross-contamination can occur in stores where food may be processed or displayed along with shellfish. It also can occur during manufacturing. Be sure to read food labels carefully. Companies are required to clearly label any product that contains even small amounts of shellfish or other foods that often cause allergic reactions.

Keep distance

You may need to completely avoid environments where shellfish are being prepared or processed. Some people even have a reaction after touching shellfish or inhaling steam from cooking shellfish.

Some people mistakenly believe that allergy to iodine or allergy to radiocontrast dye used in some laboratory

procedures can cause reactions in people with a shellfish allergy. Reactions to radiocontrast material or iodine are not related.

POST SCRIPT - A NOTE TO THE ORTHOPAEDICIAN

Glucosamine, a supplement used to prevent and treat arthritis, is made from crab, lobster, or shrimp shells. While it does not appear to cause an allergic reaction in most people who have a shellfish allergy, more studies need to be done to determine whether it is safe for people allergic to shellfish.

MED ALERT BRACELETS, NECKLACES, AND MEDICAL IDENTIFICATION TAGS

The intention is to alert a paramedic, physician, emergency department personnel, or other first responders of the condition even if the wearer is not conscious enough or old enough to explain. Some people prefer to carry a wallet card with the same information.

A new type of medic identification alert is the USB medical alert tag. This is essentially a USB flash drive that contains an individual's emergency information and can carry much more information than the conventional medical ID bracelet. Information such as medications, existing conditions, doctors, and emergency contacts can all be stored on the USB tags.

Use of Inj. EpiPen (Epinephrine-Adrenaline)

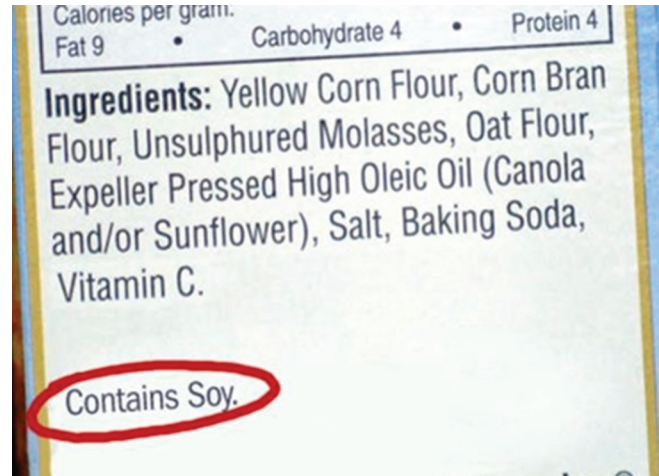
If you are at risk of a serious allergic reaction, talk with your doctor and relatives about carrying Inj. EpiPen (emergency epinephrine adrenaline).

1. RECOGNIZE the signs and symptoms are life threatening or not
2. REACT quickly activate the emergency care plan
3. REVIEW what caused the reaction and do the plan work.

Recommendations for India

1. All the restaurants who serve the seafood should notify the customers regarding the use of seafood in the menu
2. Warning should be given to customers regarding the allergic reactions
3. All the restaurants who serve the seafood should maintain the EMERGENCY DRUGS as a precautionary measure as emergency can occur
4. Health education must be given to the asthmatic, nasal allergy patients as they have bit higher incidence of seafood allergy

5. Patients who consume wine also should be alerted as fish products can be used as clarifying or fining agents in the manufacture of some wines
6. Medications, various health foods, and cosmetics may have ingredients derived from seafood, and labeling of non-food items should be strictly regulated by the government department and other health organizations to avoid unpleasant reactions.



IS THERE A TREATMENT FOR SEAFOOD ALLERGY

Shellfish are divided into two main groups. The crustaceans include crab, shrimp, and lobster, and the mollusks include scallops, clams, mussels, and oysters. Typically, it is seen that the people who are allergic to a certain kind of seafood will also be allergic to others within the same group. It is not so common to be allergic to all types of seafood. However for the individuals who are allergic to any one seafood, it is recommended to consult a doctor before they attempt to eat any other seafood. Although the best way to prevent any form of allergic reaction is to keep away from all forms of shellfish, there are instances in which one inadvertently consumes them. The best way to treat mild allergic reactions such as itching and rash is to take antihistamines such as loratadine or diphenhydramine. Applying calamine lotion and ice on the hives also helps to reduce the discomfort by shrinking the blood vessels and hence reducing the inflammation. Taking milk of magnesia and peppermint tea also helps to relieve the milder symptoms. In case of a severe allergic reaction like anaphylaxis, it is always required to take an injection of epinephrine or adrenaline and carry injectable epinephrine or an EpiPen with them. Epinephrine needs to be taken as soon as an allergic reaction is suspected. Epinephrine is a very powerful bronchodilator that can combat the effects of the potentially life-threatening anaphylactic shock. Hence, adults with shellfish allergies should be aware of

how to use this on themselves or on their child if the child has a suspected shellfish allergy. It is also recommended for such individuals to wear a medical alert bracelet or necklace so that health care workers may be aware of their condition as emergency. Moreover, we must follow the adage that PREVENTION IS BETTER THAN CURE.

PERSISTENCE, TOLERANCE, AND RECURRENCE

Seafood allergy is considered to be persistent in most cases. In a study evaluating IgE binding to various epitopes of major shrimp allergens, children showed stronger and more diverse IgE binding than adults, implying the allergy may wane with time. American telephone-based survey, only 3–4% of individuals with seafood allergy reported developing tolerance overtime. However, loss of fish allergy during childhood or in adulthood has been reported, although the extent to which this occurs is not well studied. Recurrence of fish allergy after tolerance has also been reported

DEATH RATES

Several deaths from seafood allergy have been recorded. In a registry of food-induced fatal anaphylaxis comprised primarily of children, 1 of 32 deaths was due to fish, and in a report of seven deaths, one was reported to crab and one to fish. In a United Kingdom registry of fatalities from anaphylaxis, 3 of 33 fatalities to a known food were caused by seafood.

THE BOTTOM LINE: BE CAUTIOUS

Always double check labels to be sure you know what you are eating and drinking. Even though a food product may have been safe the last time you purchased or consumed it, it is possible that the ingredients have changed, or the label has been updated. If you have any doubt about food ingredients, contact the manufacturer about whether the food could possibly contain a food allergen. In this era of mobile phones with camera please photograph the labels to see the changes in the label or food constituents and compare to see the changes.

FUTURE STRATEGIES

New strategies may help overcome food allergies.

- Oral immunotherapy: Under close supervision by health-care professionals, patients swallow tiny but gradually increasing amounts of the foods that trigger

their allergies, with the idea of building immunity. This method is being tested for peanut, egg, and milk allergies

- Sublingual therapy: Drops containing proteins that trigger allergies are put under the tongue, where they are absorbed into the bloodstream. This method is being tested for various food allergies
- Food allergy herbal formula 2 (FAHF-2): Known as FAHF-2, this pill (not available in stores) is based on a 2000-year-old Chinese remedy. It contains nine botanicals, including ginseng and oil made from cinnamon tree bark. It is being tested for peanut, tree nut, fish, and shellfish allergies.

CONCLUSION

Seafood allergies are most common in young adults and adolescents but can also be seen in children. The allergic reaction is because of hypersensitivity reaction to the proteins present in these foods which are mainly the parvalbumin and tropomyosin which induce IgE-mediated immunologic response and cause release of histamine and other chemical mediators from the mast cells, causing mild to severe allergic reaction and in some cases severe anaphylactic reaction. Thus, the main *per se* treatment is prevention and we must follow the adage that PREVENTION IS BETTER THAN CURE. In cases with mild allergy, symptomatic treatment is given. In severe anaphylaxis, Inj. EpiPen is used as an emergency drug. There are many strategies coming up in future and building tolerance in the children to overcome their food allergies is one of the efforts taken.

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