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Salmon roe anaphylaxis in an eight-year-old male

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Abstract: Whereas testing for allergens such as fish and shellfish is considered standard practice in allergy and immunology, the accurate diagnosis of more uncommon seafood allergens, such as salmon roe, can be challenging. The prevalence of salmon roe allergies, especially in western countries, is not well established. Here, we discuss the case of an eight-year-old male who presented to our clinic with a history of anaphylaxis to salmon roe, the testing performed to verify his salmon roe allergy, and the proteins that may be responsible for triggering his allergic reaction. Results from skin prick testing and an in-office oral food challenge support the accuracy of his salmon roe allergy diagnosis.

Keywords: seafood; salmon roe; hypersensitivity; anaphylaxis; vitellogenins; lipovitellin.

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1 Introduction

Finned fish are one of the most common allergens in the US with an estimated prevalence of 1% and can cause food-induced anaphylaxis (Minhas et al., 2017; FARE, 2025). As such, the proper treatment and management of seafood allergies is crucial, especially in young children who may experience a high degree of exposure to various allergens in their school and home environments. In the general pediatric American population, studies have reported finned fish allergies at 0.3–0.6%, equivalent to between roughly 220,000–440,000 children today (Kalic et al., 2021). Despite the high prevalence of finned fish allergies, reporting on allergies to fish roe (eggs) is rarely reported. Whereas fish roe allergies are not uncommon in certain countries where it is regularly consumed – for example, it is the sixth most common food allergen in Japan – it is an emerging allergen in western countries (Minhas et al., 2017; De Paulis et al., 2022; Cosme et al., 2019). To our knowledge, there have been five reported cases in Europe and only two reported cases so far in the USA (Minhas et al., 2017; De Paulis et al., 2022; Cosme et al., 2019; Robertson et al., 2023). Diagnostic testing in previous literature has involved the use of bloodwork to determine food-specific IgE levels as well as tryptase levels, SDS-PAGE immunoblotting, and skin prick testing (SPT) (De Paulis et al., 2022; Cosme et al., 2019; Robertson et al., 2023). In this study, we describe a case of an eight-year-old male from the USA presenting with a history of anaphylaxis to salmon roe without concomitant allergy to salmon meat. Our primary objective was to obtain data supporting the diagnosis of an immunologically true salmon roe allergy and to discuss the importance of clinical recognition, treatment, and management.

2 Case description

An eight-year-old male presented to our clinic for SPT for an anaphylactic reaction to salmon roe several months prior. During his reaction, he experienced nasal congestion, ocular pruritus, and an itchy throat. His symptoms resolved after one dose of cetirizine. His SPT measured positive for salmon roe (16×18 mm) and the histamine control (5×10 mm). The saline control was negative (0×0 mm).

The patient returned for a follow up visit two years after the initial SPT to re-test for his salmon roe allergy. SPT was conducted at this visit for salmon roe, Atlantic salmon, and whitefish. Both the salmon roe and whitefish were fresh prick-to-prick, whereas Atlantic salmon was an extract. The results of his SPT at this visit are shown in Figures 1 and 2.

Figure 1 Follow up SPT results (1) (see online version for colours)



Notes: Description: SPT results from the patient's follow up visit. The positive histamine control measured 5×7 mm.

Figure 2 Follow up SPT results (2) (see online version for colours)



Notes: Description: findings from the patient's SPT at his follow up visit. The fresh salmon roe (SR) prick was 3×3 mm. The negative control (-), Atlantic salmon (S), and fresh white fish (WF) pricks were all negative. The positive histamine control reaction is no longer visible due to time.

The patient consequently returned for an oral food challenge to salmon roe. After consuming his first dose (one roe), he reported experiencing an itchy throat and the food challenge was stopped. 10 mL of cetirizine was given immediately and his symptoms resolved within 10 minutes. Following his reaction, he was observed in the office for 60 minutes and discharged in stable condition.

3 Medical history

The patient has a past medical history significant for other food allergies. He reports an episode of anaphylaxis to pine nuts, as well as an allergic reaction to Pho. Skin testing has returned positive for pine nuts but negative for other tree nuts, peanut, and sesame seed. Past bloodwork showed elevated pine nut IgE and sesame seed IgE. He ingests salmon meat and chicken eggs without issue.

The patient also has a history of food allergies in his family. His biological father has a history of oral allergy syndrome to fruits, vegetables, and nuts. His father also reports a seafood allergy specific to raw 'sweet shrimp', also known as Ama-Ebi. His paternal aunt reports an allergy to apples but denies seafood allergies. The patient denies a family history of allergies on his maternal side.

4 Discussion

Given his past medical history, positive skin prick tests, and failed oral food challenge, the diagnosis of salmon roe allergy was confirmed. Comparing his SPTs, there are significant differences in the wheel and flare for the salmon roe pricks. SPT at his initial visit showed a positive salmon roe prick of 16×18 mm, whereas SPT from his follow up visit showed a positive salmon roe prick of 3×3 mm. We believe that these differences may be due to sourcing and the quality of food processing, as the roe used for these skin prick tests were obtained from separate facilities. While it is possible that the less reactive salmon roe prick from his follow up SPT was related to the antihistamine that the patient took two days prior to his visit, the comparable size of the positive histamine control for both SPTs suggests that differences were not due to interference by medication. These findings suggest that the quality of sourcing and food processing may influence the trajectory of an individual's allergic response to immunogens.

Research is limited so far regarding the specific biological trigger in salmon roe that induces anaphylaxis. Two protein components in eggs, vitellogenin and lipovitellin, have been identified as potential triggers (Robertson et al., 2023). Vitellogenin is a protein found in various kinds of female eggs and is a precursor to egg yolk (Li and Zhang, 2017). Lipovitellin, a major protein found in the yolk of eggs laid by animals, is cleaved from vitellogenin and stores lipids and metals (Li and Zhang, 2017; Thompson and Banaszak, 2002). In support of their potential role in the allergy response cascade, authors in one study conducted immunoblotting using sera from patients who had experienced anaphylaxis to salmon roe (Kondo et al., 2005). They identified IgE binding patterns to proteins with similar amino acid sequences to the vitellogenin precursor protein in rainbow trout fish. In addition, they performed an ELISA inhibition assay which demonstrated no cross reactivity between salmon roe and chicken egg yolk. Cosme et al. (2019) also report that chicken eggs and salmon roe proteins lack cross-reactivity,

and Robertson et al. (2023) further report a lack of cross-reactivity between the suspected allergens of salmon roe (vitellogenin and lipovitellin) and parvalbumin, the major allergen in fish muscle (Cosme et al., 2019; Robertson et al., 2023). These findings are consistent with the ability of the patient in our case study to tolerate chicken eggs and salmon meat despite having an allergy to salmon roe. However, if vitellogenin and lipovitellin are in fact indicated as biological triggers in patients with salmon roe allergies, it remains unclear why they trigger anaphylaxis only in some food contexts (salmon roe) but not others (chicken eggs).

5 Conclusions

This case report contributes to an emerging body of research on salmon roe allergies. In the present study, we describe the third reported case of salmon roe anaphylaxis in the USA. While it remains unclear which components of salmon roe induce anaphylaxis, the proteins vitellogenin and lipovitellin have been identified as potential biological triggers. Further research is needed to understand their exact mechanism of action, and the severity of a reaction may be further impacted by the sourcing and chemical processing of the allergen. We hope these findings help clinicians to better manage seafood allergies and guide patients' dietary choices.

Declarations

Conflicts of interest: All authors declare that they have no conflicts of interest.

Informed consent statement: Written informed consent was obtained from the legal guardians of this patient to publish this case report along with all accompanying visual elements.

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