

## Case Report



# Home-based, slow up-dosing oral immunotherapy for hen's egg allergy in an adult patient

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### Conflict of Interest

The authors have no financial conflicts of interest.

### Author Contributions

Conceptualization: Satoshi Horino. Formal analysis: Satoshi Horino. Investigation: Satoshi Horino. Methodology: Satoshi Horino, Kei Uneoka, Masato Nihei, Haruka Aki, Katsushi Miura. Project administration: Satoshi Horino.

## ABSTRACT

Standard therapy for food allergies involves avoiding causative foods until a patient has outgrown their allergies. Oral immunotherapy (OIT) is an optional treatment for children unlikely to outgrow their food allergy. However, information about OIT in adult patients with food allergies is very limited. We present a case of severe hen's egg allergy (HEA) in an adult who tried home-based, slow up-dosing OIT, reported to have been tolerable and effective in children. A 20-year-old woman with HEA experienced repeated anaphylaxis since childhood when she consumed a small quantity of hen's egg, so she completely avoided hen's eggs. She underwent inpatient oral food challenge (OFC) with 10-g boiled egg yolk and presented lip swelling and abdominal pain. OFC with 1-g boiled egg yolk the following day induced no adverse reaction. OIT was initiated using a home-based, slow up-dosing protocol. She consumed 1 g of boiled egg yolk at home every day, increasing this by 5%–10% every 2 weeks. She started 0.5-g boiled egg white after reaching a whole egg yolk. If adverse reactions occurred, the daily dose was decreased. After 59 months, she was able to eat an entire boiled egg. Anaphylaxis occurred 3 times during OIT due to accidental consumptions of egg products or insufficient heating of egg. Home-based, slow up-dosing OIT might be applicable for adults with severe HEA. It should be performed with appropriate equipment and education for patients, in case of emergency.

**Keywords:** Food hypersensitivity; Desensitization, Immunologic; Adult; Immunotherapy

## INTRODUCTION

Hen's egg is a common allergen among immunoglobulin E (IgE)-mediated food allergy in children. The majority of children with hen's egg allergy (HEA) outgrow their allergies; therefore, the morbidity rate of HEA in adults is expected to be very low [1].

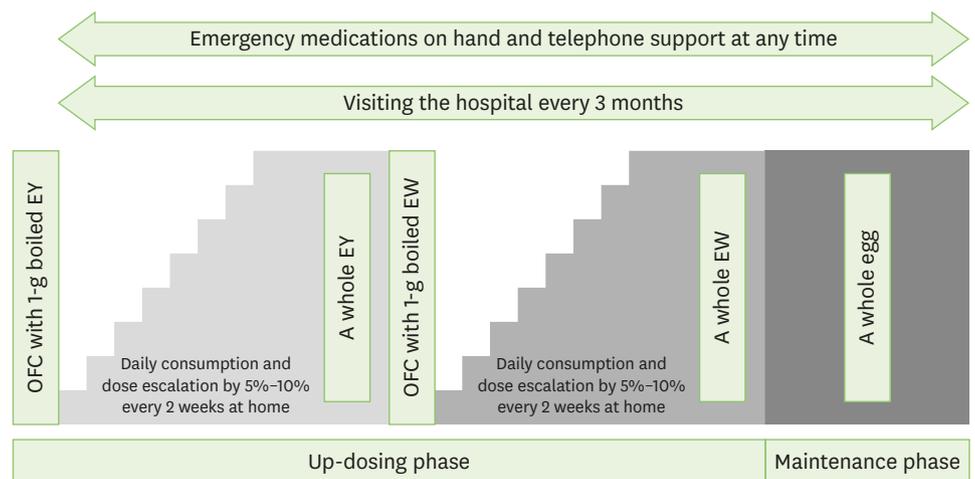
Standard therapy for food allergy involves avoiding the causative foods until the patient has outgrown the allergy. Oral immunotherapy (OIT) is an optional treatment for children unlikely to outgrow their food allergy. Typical protocol for OIT involves an initial dose-escalation phase in the hospital, an outpatient build-up phase, and a maintenance phase [2]. It usually needs weeks or months to reach the maintenance dose. Home-based slow

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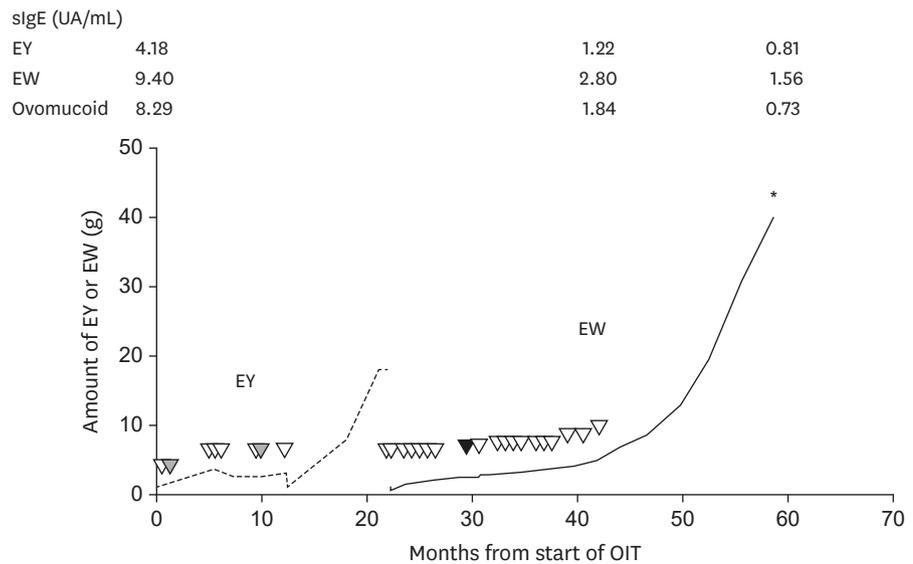
up-dosing protocol is modified for severely allergic patients and involves omission of the inpatient dose escalation and using longer durations for escalating the dose to achieve oral tolerance induction safely [3]. This protocol presented a reduction in the adverse events related to doses administered at home [4]. A Japanese nationwide survey of OIT also showed that the frequency of immediate allergic reaction was significantly higher in inpatient OIT than in outpatient OIT at home [5]. Most of patients treated with OIT were children younger than 20 years old [6]. Therefore, information about OIT in adult patients with food allergies is limited, and whether home-based, slow up-dosing protocol could be effective in adult patients with severe food allergy is unknown. Herein, we report a case of severe HEA in an adult patient successfully treated with modified home-based, slow up-dosing OIT.

## CASE REPORT

A 20-year-old woman with HEA experienced repeated anaphylaxis since childhood even with a small quantity of hen's egg; hence, she completely avoided hen's eggs. She requested treatment for HEA and was admitted to Miyagi Children's Hospital. She also exhibited hypersensitivity to fish and shellfish with prior histories of skin rash and oral itching, and had atopic dermatitis. At the time of admission to our hospital, the levels of serum specific IgE (sIgE) to egg yolk (EY), egg white (EW), and ovomucoid were 4.18, 9.40, and 8.29 UA/mL, respectively, based on the ImmunoCAP assay (Phadia, Thermo Fisher Scientific, Uppsala, Sweden). She underwent the inpatient oral food challenge (OFC) with 10-g EY that was boiled at 100°C for 20 minutes, and developed lip swelling and abdominal pain. OFC with 1-g boiled EY the following day induced no adverse reaction. Written informed consent for performing OIT and publishing clinical details in this report was obtained from the patient, and we employed a home-based, slow up-dosing protocol (**Fig. 1**). Besides, the increasing rate was set lower than in previous studies for children [4, 7]. This is because the susceptibility threshold is very low and she had repeated anaphylaxis owing to hen's egg; therefore, we were concerned that the sudden increase in dose could induce severe allergic reactions. The OIT protocol was approved by the Miyagi Children's Hospital Ethics Committee (approval number: 108).



**Fig. 1.** A home-based, slow up-dosing protocol. EW, egg white; EY, egg yolk; OFC, oral food challenge.



**Fig. 2.** Clinical course of oral immunotherapy. Boiled egg yolk (dotted line) was consumed every day for the first 22 months, followed by daily consumption of boiled egg white (solid line). Black, grey, and white triangle shows anaphylaxis due to insufficient heating of egg, those induced by accidental consumption of egg products, and mild immediate reactions after any consumption of egg, respectively. \*She reached a boiled whole egg white and then kept the dose as a maintenance phase. EW, egg white; EY, egg yolk; OIT, oral immunotherapy; sIgE, specific IgE.

She was equipped with an automatic adrenaline injector, inhaled bronchodilator, and antihistamines, and was trained on when and how to properly administer them. OIT was initiated with boiled EY because it was less allergenic than EW [8]. Boiled EYs were strictly separated from EW after boiling in the same way as OFC and weighed at home. She consumed 1-g boiled EY at home every day, increasing this by 5%–10% every 2 weeks (Fig. 2). She was instructed to stop regular consumption of egg if she had an infection, fatigue, or other unfavorable physical condition. If adverse reactions occurred, the daily dose was decreased, as determined appropriately by her attending doctors. She visited the hospital approximately every 3 months, and was interviewed for adverse events and adherence to protocol. In addition, we responded to her inquiries using telephone call during OIT at home. After reaching the stage where a whole EY was ingested, she underwent OFC with 1-g boiled EW in the hospital after which she had nausea. Then she started regular consumption of 0.5-g boiled EW and continued increasing the dose at the same rate as that of EY. After 59 months, she ingested a whole boiled EW. Anaphylaxis induced by OIT, such as repeated vomiting, diarrhea, continuous abdominal pain, and urticaria occurred once, 30 months after the initiation of OIT. She was treated with an intramuscular adrenaline injection and an oral antihistamine. This adverse event was suspected to be due to shortened heating time of egg by her mistake. There were also 2 incidences of anaphylaxis, induced by accidental consumption of egg products (Fig. 2). Mild immediate reactions such as mild nausea, oral itching, and mild brief abdominal pain frequently occurred; however, these symptoms did not appear after 43 months from starting OIT. Except for a few anaphylaxis events, she could continue performing OIT at home without disrupting her daily work as a kindergarten teacher.

## DISCUSSION

The patient's course addresses an important clinical issue. Adult patients with severe HEA could be treated using OIT with home-based slow up-dosing protocol. Efficacy and safety

of OIT for adult patients with HEA are not established. The previous reports were limited to the typical protocol [9] and in-hospital rush protocol [10]. In both the reports, patients with severe HEA who underwent OIT appeared to develop systemic reactions and some of them failed to increase the dose. Although the patient in our case also presented some episodes of anaphylaxis during OIT, they were not due to our protocol but accidental consumptions or insufficient heating of egg. She could be desensitized well after reaching 6-g boiled EW, and finally could eat a boiled whole egg. It is assumed that the present protocol which reduced the dose increasing rate compared to past reports for children might be safe and could desensitize an adult patient with severe HEA. The present case spent a long period of time for OIT because of mild reactions; however, this seemed inevitable to avoid profound allergic reactions. This protocol needs fewer days of hospitalization than the typical or rush protocol, and might be tolerable for patients who have daily occupational work. Allergic reactions including anaphylaxis could be induced during OIT; therefore, patients should be equipped with prior equipment and appropriate education, in case of an emergency.

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