

Anaphylactic Reactions on the Beach: A Cause for Concern?

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Background. The commonest causes of anaphylaxis include hymenoptera bites, high-risk food, exercise, and jellyfish bites and may often be encountered on the beach. Therefore, millions of visitors at popular touristic locations are exposed to increased risk of anaphylactic reactions every year. At least 35 cases of acute allergic reactions requiring medical attention took place on the beaches of Crete, Greece during the previous summer.

Objective. To evaluate the level of training of lifeguards working on the beaches of the island of Crete, Greece, with regard to emergency management of anaphylaxis as well as to assess the sufficiency of medical equipment that lifeguards possess to treat an anaphylactic reaction.

Methods. A questionnaire was prepared by the authors and administered to 50 lifeguards working on various beaches of Crete. Queries included the definition of anaphylaxis, proper medical treatment, and the existence or not and composition of an emergency kit with regard to the management of acute allergic reactions.

Results. Our series consisted of 50 lifeguards, 39 (78%) male and 11 female (22%). Although 41 (80%) lifeguards were aware of an acceptable definition of anaphylaxis, no one knew that epinephrine is the first-choice treatment, and 32 (60%) lifeguards replied that steroids should be used for emergency treatment. Additionally, no one possessed an emergency kit that would qualify for management of acute allergic reactions.

Conclusions. The beach should be considered as a high-risk place for the appearance of anaphylactic reactions. Lifeguards who would be the first trained personnel to encounter this condition should be sufficiently trained and equipped for emergency treatment. Our department is currently introducing a training program to local authorities for the proper training and equipping of lifeguards in the island of Crete.

Anaphylaxis is an acute, severe reaction that results from the release of preformed and newly synthesized bioactive mediators from mast cells and basophils.¹ More than 500 fatal cases of anaphylaxis per year are estimated to occur in the United States, while more than 12 deaths are reported in Greece.¹⁻⁴ Foods, venoms, and drugs are the most common exogenous antigens, which can provoke an immunoglobulin (Ig) E-mediated reaction, whereas exercise, radiocontrast media, as well as nonsteroidal anti-inflammatory drugs may induce clinical symptoms with a not yet completely understood mechanism. When no etiologic agent is found despite repeated evaluations, the term idiopathic anaphylaxis is used.² Food allergy, in particular, is often implicated in multiple allergies as well as in several reactions such as anaphylactic shock, laryngeal angioedema, and severe acute asthma.^{5,6}

Crete is a 1,000 km coastline island in the south of Greece. Every year almost 3 million tourists visit this island and enjoy its beaches. Some of the commonest

causes of anaphylaxis, including hymenoptera bites, high-risk food, exercise, and jellyfish bites, are often encountered on the beach. Even though the risk of anaphylaxis in schools and other public places has been emphasized by various authors, no studies regarding the risk of anaphylactic shock on the beach have been reported so far.³⁻⁸

We evaluate the training level of lifeguards working on the beaches of the island of Crete regarding the management of anaphylaxis. In addition, we assess the sufficiency of medical equipment that lifeguards possess to treat an anaphylactic reaction.

Method of Study

A prospective, randomized study was conducted in an academic tertiary referral medical center (Department of Otolaryngology, University of Crete School of Medicine, Heraklion, Crete, Greece). A questionnaire was prepared and administered from May 2007 to July 2007 to 50 lifeguards, covering more than half of the organized beaches in the island of Crete. The anonymous questionnaire referred to the definition of anaphylaxis, proper medical treatment, and the existence or not as well as the

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composition of an emergency kit with regard to the management of acute allergic reactions. Subjects were asked to complete the questionnaire immediately after they obtained it to avoid prepared answers. The research protocol was approved by the Ethics Committee of the University Hospital of Crete.

Results

All questionnaires were fully completed and returned to the authors. Therefore, our series consisted of 50 lifeguards, 39 (78%) male and 11 female (22%). Although 41 (80%) lifeguards were aware of an acceptable definition of anaphylaxis, no one (0%) knew that epinephrine is the first-choice treatment, and 32 (60%) lifeguards replied that steroids should be used for initial emergency management. Additionally, no one (0%) possessed an emergency kit that would qualify for management of acute allergic reactions.

Discussion

Anaphylaxis is an acute and potentially life-threatening allergic reaction resulting from generalized mast cell degranulation, with the systemic release of chemical mediators, including vasoactive substances such as histamine, leukotrienes, eosinophilic chemotactic factors, and neutrophilic chemotactic factors. These vasoactive substances are responsible for the clinical manifestations of the allergic response, such as smooth muscle spasm resulting in bronchospasm, mucosal edema, and inflammation. The cardiovascular system may also be involved, with symptoms including tachycardia, hypotension, cardiac dysrhythmia, and complete cardiovascular collapse.³⁻⁵ The hypotension associated with an anaphylactic reaction may be severe and unresponsive to treatment.⁶ Death due to anaphylaxis may result from airway obstruction secondary to laryngeal and upper airway edema and bronchospasm, but often death results from cardiovascular collapse and shock rather than asphyxia.⁷ Clinical signs and symptoms are usually rapidly progressive, beginning within minutes or sometimes seconds after exposure to an antigen, although reactions may be delayed for up to 24 hours.

About 12 patients die per year in Greece and 500 to 1,000 in the United States due to anaphylaxis. It is estimated that food allergy in particular affects approximately 2% of the general population and 8% of children and that approximately 100 to 125 individuals die each year in the United States from food-induced anaphylaxis.^{3-5,8} While any food protein has the potential to trigger an immunologic reaction, there are only a few substances that are responsible for the vast majority of food-associated hypersensitivity reactions and severe anaphylaxis.⁹ In children, these antigens include milk, eggs, soya, nuts, and wheat, whereas in adults, peanuts, tree nuts, fish, and shellfish are foods most commonly associated with allergic reactions. The majority of the pre-

mentioned foods can be found in abundance in beach bars and are also commonly sold by food vendors on the beaches of Crete. It should be noted that no law exists in Greece enforcing the declaration of potentially allergic foods on the menus of restaurants and bars.

Strenuous physical activity can precipitate a hypersensitivity reaction known as exercise-induced anaphylaxis (EIA). This is characterized by the development of pruritus, flushing, angioedema, generalized urticaria, respiratory distress, and cardiovascular collapse during exercise.^{10,11} Symptoms may range from skin manifestations to life-threatening anaphylaxis. EIA may mimic cardiac arrhythmia and may be due to other pathogenic mechanisms, such as coronary arteriosclerosis. When EIA includes skin and respiratory manifestations, the reaction can be more easily distinguished from a sudden cardiac event due to underlying cardiac pathology. However, anaphylactic shock may result in a cardiac arrhythmia in the absence of cutaneous and respiratory symptoms and may result in an acute myocardial infarction due to coronary artery vasospasm. Therefore, an anaphylactic reaction should be considered in the differential diagnosis for the sudden cardiac deaths during exercise. The symptoms of EIA may not be reproduced always with the same level of exercise for the same time period in a particular individual, suggesting that other factors may play a role in the development of the anaphylactic response.

Food ingestion is a well-recognized factor in the exacerbation of EIA.^{12,13} Exercise-induced food allergies are being recognized with increased frequency. Food-dependent EIA occurs when exercise follows the ingestion of the particular food.¹⁴⁻¹⁷ Most individuals experiencing food-dependent EIA have symptoms within a few hours of exercise.^{8,11} This is due to the synergistic effect between the allergen-specific IgE antibodies from the recent food ingestion and exercise. The individuals can either ingest the specific food or exercise on different occasions without invoking an allergic reaction. The symptoms can be produced only after ingestion of the specific food within the previous few hours before exercise. Even though allergic food ingestion usually causes anaphylactic symptoms when it takes place prior to the exercise, there are reported cases where the ingestion of food shortly followed the exercise.¹⁰ Beaches are considered an ideal place for physical exercise. This exercise, often under extreme heat, combined with the ingestion of allergic food makes the beach a particularly dangerous place for potential anaphylactic reactions. Vigorous dancing is very common at beach bars, while water sports as well as team sports like beach volley and soccer thrive on the organized beaches of Crete. It should be noted that under Greek law, no medic or paramedic personnel is obliged to oversee these kinds of activities even in organized beaches. On the other hand, surveillance of organized beaches by at least one trained lifeguard during daytime is mandatory in Greece. Lifeguards would therefore be the only trained beach personnel to assist people in case of a medical emergency.

Hymenoptera bites are another important cause of anaphylactic reactions. Fewer than 100 fatal reactions to hymenoptera stings are reported each year in the United States, but this is considered to be an underestimate.³ Humid places with steady water like public showers and locker rooms on the beach are friendly to various species of hymenoptera. Therefore, a high incidence of hymenoptera bites and potential anaphylactic reactions should be expected on the beach. In fact, at least one death was officially reported on the beaches of Crete during the previous summer due to an anaphylactic reaction that resulted from a hymenoptera sting.

Crete has a coastline more than 1,000 km long and consists of both sandy beaches and rocky shores. Blue flag beaches are recognized as having high environmental, sanitary, and safety standards. Crete has in total 97 blue flag beaches and takes the 15th place in the world classification of tourist destinations. According to the Statistics Department of the Hellenic Tourism Organization (1997), every year incoming tourism in Greece counts 14,179,999 people, while 2,838,548 tourists visit the island of Crete. The majority of visitors, approximately 75%, come from the European Union. The tourist period corresponds to a 6-month period, from May to October. The allergic profiles of the Cretan population have been previously studied.^{18,19}

Every year more than 100 anaphylactic reactions are managed by the Greek National Emergency Ambulance Service (EKAB) in Crete. More than 40% of these occur on the beach. An accurate account is not possible due to insufficient documentation. Nevertheless, the University Hospital of Crete, which covers more than half the population of the island for emergency cases every other day, recorded at least 35 cases of anaphylactic reactions that occurred on the beach last summer. Among these cases, 20 were admitted for hospitalization, while 2 cases were managed with emergency endotracheal intubation and spent time in the intensive care unit due to a life-threatening anaphylactic reaction. Moreover, during the previous summer, at least one death due to anaphylaxis took place on the beaches of Crete. It should be mentioned here that it is not possible to know how many additional deaths that occurred on the beach and were attributed to other causes, including drownings and cardiac arrests, were in fact related to anaphylactic reactions.

Anaphylaxis is an emergency condition requiring immediate professional medical attention. Assessment of the ABCs from Basic Life Support should be performed in all suspected anaphylactic reactions. Cardiopulmonary resuscitation (CPR) should be initiated if needed. People with known severe allergic reactions should carry an epinephrine autoinjector and should be assisted if necessary. Unfortunately, almost one in five cases of anaphylaxis does not have a previous history of moderate-to-severe allergic reactions and therefore does not possess an allergy kit. Emergency interventions by paramedics or physicians may include endotracheal intubation, trache-

otomy, or cricothyrotomy. Some specialists insist that epinephrine should be given by injection as first-line treatment without delay even by nonmedical personnel. When an autoinjector is not available, intramuscular injection can be done by any person near the patient. According to other authors, the issue of out-of-hospital use of adrenaline is still open, as discussed later in this section.²⁰⁻²⁴ Additional management of shock typically includes administration of intravenous fluids, while antihistamines, such as diphenhydramine, and corticosteroids, such as prednisone, may be additionally given to reduce symptoms but only after lifesaving measures and epinephrine are administered. Inhaled β -agonists should also be included in an allergy emergency kit and administered when necessary.^{4,8,11,20}

Lifeguards and other personnel of places like beach bars and restaurants should have the proper equipment and training to manage anaphylactic reactions on an emergency basis. The use of epinephrine by basic life support personnel in emergency settings has been previously proposed by other authors.^{21,22} On the other hand, a universal approach regarding that matter has yet to be adopted in most countries. This is due to, among other factors, lack of sufficient epidemiologic data regarding out-of-hospital use of epinephrine and lack of a commonly agreed upon case definition of anaphylaxis.²¹ Things are additionally perplexed when considering the potential serious complications related to the use of epinephrine, including fatal dysrhythmias, pulmonary edema, and cerebral hemorrhage.^{21,23}

Nevertheless, the literature does not suggest that field use of epinephrine is unsafe, and, as mentioned earlier, its efficacy has been shown in other settings like schools.^{20,21}

In our study, 41 (80%) lifeguards were aware of an acceptable definition of anaphylaxis. On the other hand, no one (0%) knew that epinephrine is the first-choice treatment, and 32 (60%) lifeguards replied that corticosteroids should be used for emergency treatment. In addition, no one (0%) possessed an emergency kit that would qualify for management of acute allergic reactions. In places like restaurants and schools, the efficiency of a specific plan and an emergency kit for the management of anaphylaxis have been previously shown.²⁰ In this study, we emphasize the need for thorough instructions and training of beach lifeguards in dealing with allergic emergencies.

All emergency kits for the management of anaphylaxis should contain the self-injectable epinephrine, particularly in places like beach bars, restaurants, and lifeguard stations on the beach. These kits should be protected from sun exposure and extreme heat. The autoinjectors should be available in pairs because it has been shown that at least one may be wasted in emergency cases.^{19,20} Interestingly, no law exists in Greece enforcing the presence of self-injectable epinephrine in restaurant and bar emergency kits.

The authors' department is currently introducing a training program to local authorities for the proper training and equipping of lifeguards in the island of

Crete. According to current standards, all candidates for lifeguard diploma in Crete follow a 2-month training program, which includes courses on Basic Life Support and other paramedic activities, including CPR, first aid for overheated patients, and so forth. This program and all other lifeguard activities are financially sponsored by the government. It is noted that people who work as lifeguards in Crete are usually students, young athletes, and sports trainers that only work part time on the beach. The aim of the proposed program was to systematically train lifeguards, with weekly lessons during the course of their general training, on the diagnosis and emergency treatment of anaphylactic reactions. In addition, an effort is made by the authors to sensitize local authorities to provide the necessary equipment for the management of such cases on the beach, including epinephrine autoinjectors.

Declaration of Interests

The authors state that they have no conflicts of interest.

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