

# Understanding anaphylaxis

Jessica Gentry

In 1972, Jackie Kwan was quietly working on her research, munching on some pistachios a coworker had brought back from the Middle East. After she had gorged herself with pistachios, she decided to take a break and proceeded upstairs to collect her paycheck. By the time she had reached the fourth floor, she began to feel very warm and extremely itchy. At that point, the reaction triggered a memory of when she was a child and the same thing had happened after she had eaten pistachio ice cream. Within 10 minutes, hives had covered her body, making her skin flush and swollen. Along with those reactions, she started to vomit and have diarrhea. She could feel her throat swell and start to close shut. Kwan was indeed having an anaphylactic reaction—an acute, life threatening medical emergency. Her symptoms were classic.<sup>3,4</sup>

## Anaphylaxis

Anaphylaxis is a very serious manifestation of the allergic response. It is an Immunoglobulin E (IgE) mediated reaction that results when mast cells suddenly release chemical mediators that overwhelm the body. “IgE antibodies attach themselves to mast cells and basophiles [type of white blood cell], priming the body for the allergic reaction... The released mediators cause blood vessels to dilate and leak fluid into the surrounding tissues and cause smooth muscle in the airways to [constrict].”<sup>3,4</sup> Since the skin, respira-

tory, and digestive tracts are rich in mast cells, the organs of these systems are the ones primarily affected in the reaction.

The onset of anaphylaxis is usually sudden. Symptoms usually begin to develop within minutes of exposure to some triggering allergic response that may result in death. “The first symptom is usually a sensation of warmth followed by intense itching. The skin flushes, hives may appear, and the face may swell. Breathing becomes difficult, and the patient may feel faint and anxious. The blood pressure may drop precipitously. Convulsions, shock, unconsciousness, even death may follow. Roughly 60% to 80% of anaphylactic deaths are caused by an inability to breath because of swollen airway passages obstructing airflow to the lungs. The second most cause of anaphylactic deaths, about 24% by one estimate is shock, caused by insufficient blood circulating through the body.”<sup>3,4</sup>

In the 1900s, Charles Richet and Paul Portier initiated research that ultimately clarified the cause of many mysterious deaths. Richet and Portier studied the toxic qualities of the tentacles of the Portuguese man-of-war. They injected dogs with the different toxins to determine fatal levels and to test whether the animals could build an immunity or tolerance to the toxin. To their surprise, some dogs receiving a second injection at very low, presumably harmless, dosage levels suddenly died. Richet and Portier

called this result anaphylactic, meaning “contrary to protection.”<sup>3</sup>

In the same period, other researchers discovered that anaphylaxis could be caused by non-toxic proteins, including animal blood serum. Richet went on to theorize that some special substances in the blood of sensitized animals must react with the toxin to produce anaphylactic disorder. He was on the right track and, in 1913, his work was recognized with a Nobel Prize.

Until the post-World War II era, horse serum, the source of an antitoxin used for diphtheria, scarlet fever, tetanus, and tuberculosis, was found to induce the reaction. Scientists have since discovered that the explosive reaction (anaphylaxis) is the culmination of a complicated sequence of events.

Today, human serum is the preferred tetanus treatment. In the meantime, penicillin has become one of the most widely administered drugs in the world and one of the most common causes of anaphylaxis.

### Causes of anaphylactic reactions

The following substances are among those reported to have caused anaphylactic reactions:

- *Antibiotics:* penicillin, cephalosporin, tetracycline, nitrofurantoin, streptomycin
- *Local anesthetics:* more than 100 kinds
- *Anti-inflammatory:* aspirin, ibuprofen, indomethacin, fenoprofen, naproxen, tolmetin
- *Enzymes:* chymopapain, chymotrypsin, streptokinase
- *Psyllium:* present in laxatives and added to cereals
- *Hormones and serum:* insulin, ACTH, parathyroid hormone, cortisone, horse antibody
- *Diagnostic agents:* iodinated contrast media dyes such as bromsulphalein (BSP)
- *Food:* most commonly, peanuts, eggs, fish, shellfish, milk, and tree nuts; less common: grains, seeds and fruits.

### Anaphylactic reaction to anesthesia

Occasionally, a patient will have a severe allergic reaction to a muscle relaxant or other drug used

during general anesthesia. This presents a concern, because the patient is anesthetized and the reaction is somewhat difficult to spot unless it shows up clearly in the skin with hives, for example. But an alert anesthesia provider will note a change in the patient’s blood pressure or breathing status, indications that the patient is in trouble, and quick action can be taken. Anaphylaxis occurs in one out of 15,000 instances, but only 3% of anaphylactic reactions during surgery result in death. Most deaths occur among adults, and it seems that the risk of anaphylaxis increases somewhat with age. Heightened sensitivity because of repeated exposure to allergens, plus generally weaker health, account for the greater



risk as time goes on. The possibility of an allergic reaction is one of the many reasons to be very conservative in using general anesthesia.<sup>3</sup>

### Anaphylactic reactions to insect stings

Insect stings are another (among many) major cause of anaphylactic death. About 40 deaths a year are attributed to insect stings, but many others probably go unrecognized.<sup>2</sup> Several studies show that some people have no warning that they may be susceptible to a life-threatening reaction to an insect sting until it occurs.

A pharmacist from Los Angeles, who was traveling to a convention in the South several years ago, was driving alone in his car when sud-

denly a yellow jacket made a direct hit on his face. He flinched, but there was no pain and he kept driving. Five to 10 minutes later, he became hot, his face puffed up and his chest became tight. He considered pulling over, but realized he needed to get to the nearest hospital, which was about five minutes away. The pharmacist recognized that he must have been having a reaction to the yellow jacket, but never knew that he was allergic at all to any kind of insect. He was treated in time and sustained no major repercussions. Unfortunately, delayed reactions to stings can lead to such serious problems, such as kidney disease, vascular disorders, fever and serum sickness, neuritis, and arthritis-like symptoms. People allergic to insect stings can be desensitized, which usually provides good protection.<sup>3</sup>

### **Miscellaneous reactions**

Surprisingly, everyday foods are a relatively common cause of anaphylaxis. Certain foods, such as nuts, eggs, fish, and seeds, are highly allergenic in some people. Anaphylaxis can occur during the transfusion of blood or blood products, as a result of antigens in the donor's blood, such as egg protein, to which the patient is sensitive.

A drug called protamine sulfate, which is derived from fish sperm, is used to counteract overdoses of the blood thinner heparin. This can cause anaphylaxis in people allergic to fish. Men who are infertile or who have had a vasectomy are commonly allergic to protamine.<sup>2,3</sup>

Seminal fluid evidently can cause anaphylactic reaction in women. A few cases have been reported and the only protection seems to be the use of a condom. Desensitization is now available experimentally for couples that want and are trying to conceive a child.

Latex allergy presents a common problem, particularly among health care workers. Details of this allergy are related in "Care of the Latex Allergic Patient" on pages 10-19.

### **Idiopathic anaphylaxis**

Idiopathic anaphylaxis by definition is a form of anaphylaxis where no identifiable stimulus can be found. The incidence in the United States has

been estimated recently at close to 33,000 cases.<sup>1,3</sup>

A typical case of idiopathic anaphylaxis is that of a healthy 35-year-old woman, in New York City, who on a normal afternoon was speaking on the phone with her stepson, who lived about 20 blocks away. He began to realize that she seemed to be ill and fading, and then she hung up abruptly. He quickly called 911 and arrived to find her unconscious with the paramedics working on her. (Her embarrassed husband, who'd been working in the home office, hadn't heard a thing until the paramedics knocked on the door).

The diagnosis at the hospital was anaphylaxis, but no cause was found. In three years, the incident never recurred, but following the advice of her doctor, the woman carries epinephrine and a card in her wallet identifying her problem. In repeated cases, ongoing doses of antihistamines and even ongoing, alternate-day doses of cortisone are used to try to stop the recurrences.<sup>3</sup>

Because of the life threatening nature of the reaction, a diagnosis and appropriate treatment including emergency protocols, are critical. To aid in the diagnosis and treatment of idiopathic anaphylaxis, an algorithm, classification system and treatment protocol were developed. Recent analysis of this protocol have shown to be both effective in placing a majority of patients into remission and decreasing the number of emergency room visits, hospitalizations, intensive care unit admissions, and high health care cost of undiagnosed and untreated cases.

### **Treatment**

For almost all varieties of anaphylaxis, there are just two treatments: avoidance and emergency measures. The main exception is insect stings, for which venom immunotherapy can be used. Occasionally, an effort is made to desensitize a drug-allergic person so that the drug can be used in treatment. This must be done under constant medical supervision in an appropriate medical facility.<sup>3,4</sup>

The key in emergency treatment is injection of epinephrine (adrenalin) as soon as possible after reaction begins. This acts to stop the release

of chemical mediators of the allergic reaction, and it buys time to get to the hospital or to call medical personnel to the scene. The patient should be in the ER or under the care of trained medical personnel within five to 15 minutes of the onset of the attack, if possible. A tourniquet can be used in the case of an insect sting on the arm or leg. First, the stinger should be removed. The tourniquet should be applied above the site of the sting and loosened every 10 minutes to allow sufficient blood circulation to the extremity. If possible, a cold pack should also be applied. The cold causes the blood vessels to constrict, which slows the venom from getting into the bloodstream.<sup>3,4</sup>

Epinephrine injections can be repeated every 15 minutes. Antihistamines may be added. Intravenous medications and fluid replacement are often indicated. Oxygen therapy and the insertion of a tube into the trachea to keep it open are frequently necessary. Corticosteroids are used to prevent a second-phase reaction later.

Immunotherapy may be attempted for patients who need treatment with a life saving drug to which they are allergic. Desensitization is managed in a medical facility over a short period of time, beginning with extremely diluted solutions of the allergen. The patient will be monitored closely as the dose is gradually increased, so they may be treated immediately if symptoms occur.<sup>3,4</sup>

Anyone who has had an anaphylactic attack, perhaps anyone in an isolated household, should have emergency epinephrine in injectable form available. This also applies to patients who are on immunotherapy. An EpiPen is a device patients can easily use in an emergency and is available as an EpiPen Jr for children who have attacks. However, some doctors prefer and recommend the Ana-kit, which contains a syringe and needle and two doses of epinephrine. Antihistamines can be kept on hand, but do not help in life-threatening situations. It is more important to use epinephrine and to get to an emergency facility quickly.

People should also wear a medic alert bracelet or carry a card stating their allergies, that they have had anaphylaxis, and the cause.



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“Experts disagree about whether certain individuals are predisposed to anaphylaxis. Many feel that people with a history of allergies are more likely to have an anaphylactic episode. Others are unconvinced that this or other factors (such as age, gender, ethnicity, or geographic location) predispose a patient to it. One thing is clear, previous exposure to allergens usually precedes the anaphylactic reaction. Sometimes people will notice that an allergen makes them feel bad in some way, perhaps mild itching or upset stomach. This may indicate that future exposure will produce a more severe reaction.”<sup>3,4</sup>

Whatever the reason may be for anaphylaxis, it is a condition that must be taken seriously.

### About the author

Jessica Gentry is a second term surgical technology student at San Joaquin Valley College in Fresno, California.

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- Which is primarily responsible for an anaphylactic reaction?
  - basophiles
  - mast cells
  - IgE antibodies
  - none of the above
- The leading cause of death by anaphylaxis is:
  - convulsions
  - shock
  - obstructed airflow
  - insufficient blood circulating through the body
- Symptoms of anaphylaxis include
  - itching and hives
  - vomiting and diarrhea
  - swelling and difficulty breathing
  - all of the above
- A common cause of anaphylactic reactions is:
  - penicillin
  - ibuprofen
  - peanuts
  - all are common causes
- Which is most likely to indicate allergic reaction during surgery?
  - skin rash
  - temperature change
  - change in blood pressure or breathing
  - none of the above
- Delayed reactions to insect stings can lead to \_\_\_\_\_.
  - kidney disease
  - vascular disorders
  - serum sickness
  - all of the above
- Anaphylaxis from undetermined sources is called \_\_\_\_\_.
  - spontaneous anaphylaxis
  - necrosis
  - idiopathic anaphylaxis
  - immuno anaphylaxis
- After an anaphylactic reaction, the patient should \_\_\_\_\_.
  - wear a med alert bracelet
  - carry epinephrine
  - carry a card with allergy and emergency contact information
  - all of the above
- Which is a false statement about anaphylaxis?
  - After a reaction, the patient will be immune to further anaphylactic episodes.
  - More than one epinephrine injection may be required to stop the reaction.
  - Corticosteroids are used to prevent a second-phase reaction.
  - Immunotherapy may help avoid anaphylaxis in the future.
- Which is the most helpful in an anaphylactic emergency?
  - antihistamines
  - cold packs
  - epinephrine
  - a tourniquet

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