Anaphylactic Hypersensitivity Reactions

2.0 Contact Hours

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Anaphylactic Hypersensitivity Reactions

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Objectives:

At the completion of this course, the learner will be able to:

1. List the four most common antigens responsible for anaphylactic hypersensitivity reactions.
2. Identify the pathophysiology of AHR.
3. Specify the medical management of AHR.
4. Identify nursing interventions for AHR.

Epidemiology

About 40.9 million people in the United States are at risk for anaphylactic hypersensitivity reactions (AHR). Severe reactions occur most commonly in response to food, medications, insect venom and latex. In the course of one year, the following will occur:

10 people will die from AHR to foods
40 will die from insect venom AHR
220 will have AHR to latex
3 will die 500 to 1000 will die from AHR to penicillin and related medicines

Milk, eggs, wheat, soy, peanuts, and tree nuts cause 90% of AHR in children. Allergies to soy, eggs, and milk are outgrown, but allergies to nuts, shellfish, and fish remain in adulthood. Shellfish causes the majority of food-related AHR in adults. AHR in response to food allergies occur rapidly and may recur hours after the initial ingestion and reaction.

Insect venom AHR occur most commonly as a result of stinging by honeybees, yellow jackets, paper wasps, hornets and fire ants. Immunotherapy using insect venom is 97% effective in preventing further AHR in susceptible people.

Latex allergies occur in about 10% of all those who wear gloves. Patients with spina bifida or congenital urinary tract problems have a 50% latex allergy rate due to the many corrective procedures required. Exposure to latex by contact with mucous membranes or internal body surfaces causes the most severe reactions in susceptible individuals.

The incidence of true penicillin allergies is small but they are the cause of 75% of all AHR deaths in adults each year. A patient who states they have a penicillin allergy should be asked the exact nature of the reaction that occurred since reactions vary. After a single exposure to penicillin, the IgE levels begin to decline within 2 months. A scratch

test may be done to verify a penicillin allergy followed by a skin injection test and oral challenge if skin tests are negative. Those who are allergic should not receive any form of penicillin or any cephalosporins which have the same beta-lactam ring as the penicillins.

The next most common medication allergies are those to aspirin and nonsteroidal anti-inflammatory drugs. These allergies are specific and do not cross-react with other NSAIDs.

Pathophysiology

Anaphylactic hypersensitivity reactions begin with exposure to an antigen. IgE antibodies to that antigen are then manufactured in abnormally large amounts by the immune system. The next time the antigen is encountered these antibodies that are attached to mast cells trigger the cell to release histamine, cytokines, and heparin. The sooner a reaction occurs after exposure, the more severe the reaction is likely to be. When another immune mechanism causes the symptoms, the reaction is known as *anaphylactoid*.

Anaphylactic hypersensitivity reactions are classified into types according to the speed of the reaction, symptoms, and the part of the immune system involved:

1. Type I reactions involve IgE, occur immediately after exposure to the antigen, and can cause a local swelling or itching or a full-blown anaphylactic reaction.

2. Type II reactions involve the complex formed by antibodies and the antigen sticking together. They also occur immediately and occur with medication allergies or the infusion of the wrong blood type.

3. Type III reactions involve tissue damage caused by the antigen-antibody complexes, occur immediately, and occur from medicine allergies or serum sickness.

4. Type IV reactions are delayed, sometimes for days. Immune cells cause a local reaction of the skin at the location of the exposure. Examples of this type include measles, TB skin test, and transplanted graft rejections.

When the mast cells release their contents, several events occur in response to chemical stimulation by cytokines, histamine, and heparin. The airways constrict, making breathing difficult. The walls of the blood vessels become permeable, allowing fluids to escape. This causes swelling of tissues, commonly at the site of exposure in the form of hives, and in the lips, tongue, epiglottis, tissues around the eyes, and hands and feet. Pulmonary edema occurs as fluids seep into the lungs. Hypovolemia occurs as fluids escape the blood vessels to enter tissues. This causes hypotension which reduces tissue and organ perfusion. If left untreated, this triggers the cascade of events known as shock.

The body requires adequate blood volume, adequate pumping action by the heart, and intact blood vessels to deliver the required amount of oxygen and nutrients to tissues and organs and to remove the waste products of metabolism. When one component is damaged, the other two strive to compensate for as long as possible before collapsing. Blood vessels constrict and the heart rate increases in an attempt to keep circulatory pressure adequate. Without the assistance of intravascular fluids and medication to stimulate the heart and counteract the action of histamine and cytokines, compensatory mechanisms will fail.

Failure of the body to compensate for inadequate blood flow results in the death of organ cells. Cells are unable to continue functioning without oxygen, nutrients, or the removal of waste products. As increasing numbers of cells die, organ function is affected. Depending on the cause of the shock, organ failure can occur slowly or rapidly. The survival of an AHR depends on the individual body's reaction, the speed of the reaction, the amount of compensation available, and the rapid availability of medical treatment. The progression of events from exposure to decompensated shock, organ failure, and death is variable. Recognition of the signs and symptoms of AHR is crucial upon presentation of the patient to the ER.

Signs and symptoms of AHR

The allergy may be known and previous AHR may have occurred. The patient or family member can then give a history of an allergy and details about the recent exposure triggering the AHR. However, the AHR may come as a surprise to the patient who didn't realize that there was an earlier sensitization or who didn't realize that they had been recently exposed to the antigen.

Signs and symptoms depend on the type of reaction and the length of time since the exposure. Patients who are aware of an allergy may have self-administered or received one or more shots of epinephrine. This helps to depress and delay a reaction but may need to be administered repeatedly at intervals.

The patient commonly feels anxiety, with the sense of impending doom or panic. Dyspnea may be present from laryngeal edema and bronchoconstriction. Stridor and wheezing may be present. The lips, tongue, and throat may itch, feel tingly, or swell. A runny nose, sneezing, and nasal congestion may occur. The patient may complain of a metallic taste in the mouth. The skin may be flushed or the patient may be pale, cool and clammy, or cyanotic. The apical rate is increased and the blood pressure is decreased. There may be cardiac arrhythmias. Nausea, vomiting, and diarrhea may be present along with abdominal cramping. Swelling may be seen at the site of exposure, in the face, and the extremities. Hives, wheals, and itching of the skin may be present. The patient may collapse and loose consciousness, progressing to cardiopulmonary arrest.

Medical management

A primary assessment upon admission will assess the ABCs and level of consciousness. The patient is placed in a recumbent position with the legs elevated if tolerated. The airway is secured via a nasopharyngeal airway, intubation, or tracheotomy as needed and oxygen is provided. Circulation is provided by chest compression if the pulse is absent or erratic. Fluid resuscitation with normal saline is administered to combat hypovolemia. Dopamine or other vasopressors may be given if needed for hypotension according to ACLS protocol. Resuscitation efforts should be prolonged since there is a good chance of response in the patient with AHR.

Epinephrine 1:1000 in dosages of 0.2 to 0.5 ml is given subcutaneously or intramuscularly every 20 minutes as needed for vasoconstriction, to reduce the permeability of blood vessels, and to relax the smooth muscles of the bronchial tree. When IV access is available epinephrine 1 to 2.5 ml diluted to 1:10,000 may be given by slow IV push every 5 to 10 minutes as needed.

Diphenhydramine 50 to 100 mg IM or IV is given to counteract histamine when urticaria or angioedema is present. Ranitidine 50 mg diluted with D5W to 20 ml may be given IV over 5 minutes. Nebulized albuterol or aminophylline 0.25 to 0.5 g IV may be given for bronchospasm. Steroids may be given to prevent the future reoccurrence of symptoms.

A tourniquet may be applied if the allergy was caused by an insect bite on the extremity. The stinger is removed with a sideways motion to avoid compression and the injection of more antigen into the skin. An injection of epinephrine 1:1000 in the amount of 0.2 ml may be administered at the site of the sting to delay antigen absorption.

The patient is observed for up to 12 hours since 25% may have a delayed biphasic reaction in which the symptoms recur within 4 to 12 hours. There is no way to predict the recurrence of symptoms so the patient is cautioned to remain with family members if they are not kept at the hospital for 24 hours of observation.

Nursing Interventions

An anaphylactic hypersensitivity reaction is a potentially life-threatening event for the patient. Efficient, confident, and compassionate nursing care will reassure the patient and family and help to dispel anxiety. Be knowledgeable about your facility's protocol for treating AHR *before* the patient hits the door. Assess vital signs every 2 to 5 minutes until the patient is stabilized, then every 15 to 30 minutes. Monitor pulse oximetry during oxygen administration.

Don't forget to massage the area of subcutaneous or intramuscular injection of epinephrine to speed its absorption. Be sure that intravenously injected epinephrine is diluted properly and injected slowly over 1 minute. Assess the pulse and blood pressure and monitor cardiac rhythm after injection by any route. Assess for signs of restlessness,

shortness of breath, chest pain or cardiac fluttering and report them to the physician treating the patient. Do not use epinephrine that has expired or is reddish brown in color. Warn the patient that the injection may sting.

Diphenhydramine may be given IV push undiluted at the rate of 25 mg per minute. Inform the patient that drowsiness may occur later. Inform the physician if there is no response to the drug. Another antihistamine may be needed.

Continue to monitor all symptoms of AHR closely as the patient recovers from the event. Anxiety will resolve as the patient recovers and is reassured that you will monitor for any recurrence of symptoms. When the patient is ready for discharge teach symptoms to watch for, side effects of any medications received, and the prevention of further AHR as warranted depending on whether the antigen is known at that time. Offer to schedule consultations for the patient.

Prevention

When AHR occurs for the first time the patient should consult with an allergist/ immunologist to receive testing to determine the causative antigen. This will identify venom, food, and penicillin or insulin allergies. Testing is not needed when the causative antigen is readily identified by the history of the event.

The patient with a severe allergy should wear allergy identification at all times. An Epi-Pen or another form of epinephrine should be available to the patient in case of an emergency. Instruct the patient thoroughly about the proper use and remind them to check expiration dates frequently. The parents of school-aged children should inform the school nurse of the allergy and be sure that epinephrine is available at the school and during field trips. Employees should inform their employers as well.

Do not give any patient medications related to the one they are allergic to. Patients with medication allergies should be given a list of all medication that may be involved in cross-reactions. Antibiotic desensitization may be possible by the administration of small doses that are gradually increased while the patient is closely monitored with resuscitation equipment nearby. Desensitization in this manner is temporary and must be repeated if the medication is needed in the future. Graded challenges of local anesthetics may be employed for anesthetic allergies. Premedication with antihistamines and glucocorticosteroids may be utilized prior to the administration of radiocontrast agents used in testing to prevent AHR.

Teach patients with venom allergies to avoid eating in areas that are attractive to the insect. Perfumes and bare feet should be avoided when going outdoors. The patient should not mow the grass, clip hedges, or handle trash or spoiled fruits.

Caution the patient with food allergies to read the labels of all purchased foods and to be cautious when eating in restaurants, at pot-lucks, or other places where the content of foods served or the manner in which it is prepared cannot be verified.

Patients with latex allergies should be treated in latex-free environments by medical and dental professionals. Non-latex gloves, blood-pressure cuffs, tubes, tourniquets, catheters, adhesives and anesthesia equipment must be used and the patient should be seen as the first patient treated that day. IV tubing must not have latex injection ports and medication vials with rubber stoppers must be avoided.

An anaphylactic hypersensitivity reaction is a very frightening experience for a patient. It can quickly progress to become a life-threatening experience as well. Rapid action by the healthcare team in response to symptoms will give the patient the support necessary to survive.

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