



TIME CRITICAL

Anaphylaxis

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MR. A, 50, IS ADMITTED to the ED with erythema, edema, and local tenderness of the skin and subcutaneous tissues of his left lower extremity. He said that he's had a fever for a few days as well as trouble breathing. He has a history of type 2 diabetes mellitus, hypertension, and asthma. He's overweight, is unsure of his allergies, and hasn't seen a healthcare provider in years.

On admission, Mr. A's oral temperature is 101° F (38.3° C), heart rate is 108 with sinus tachycardia, respiratory rate is 20 regular and slightly labored, BP is 180/90 with the head of bed at 30 degrees, and SpO₂ is 94% on room air. The nurse auscultates expiratory wheezes bilaterally. Blood and urine specimens are obtained and sent to the lab.

Clinical decisions

The nurse establishes peripheral venous access and starts an infusion of 0.9% sodium chloride solution at 60 mL per hour. The healthcare provider prescribes an inhaled bronchodilator and I.V. ampicillin, a broad-spectrum antibiotic, for left lower extremity cellulitis.

Within 15 minutes of starting the antibiotic, Mr. A's wheezing suddenly increases; he becomes dyspneic and complains of dizziness, itchy skin, and abdominal cramping. Noting urticaria and flushed skin, the nurse quickly reassesses his vital signs: heart rate, 140 with sinus tachycardia; respiratory rate, 32 noisy and clearly labored; BP, 80/60; and SpO₂,

90% on supplemental oxygen at 2 L per minute via nasal cannula. Suspecting an allergic, possible anaphylactic, reaction to the antibiotic, the nurse immediately calls for assistance, stops the antibiotic infusion, disconnects the I.V. line, and attempts to aspirate the line. A nurse colleague ensures airway patency and oxygen delivery, obtains vital signs, and prepares for emergency interventions, while another venous access is established.

Life-threatening reaction

Anaphylaxis is a potentially fatal disorder. In *Drug Allergy: An Updated Practice Parameter*, anaphylaxis is defined as an immediate systemic reaction that occurs when a previously sensitized individual is reexposed to an allergen. It's caused by rapid IgE-mediated immune release of vasoactive mediators from tissue mast cells and peripheral basophils with a potential late component.¹ Anaphylaxis is the most rapid and severe type I, IgE-mediated hypersensitivity reaction. (See *Anaphylaxis reaction*.)

In susceptible persons who are highly sensitized to specific allergens, the anaphylactic reaction develops within minutes to hours of exposure to the offending allergen. Common triggers include food, insect venom, and medications, such as ampicillin.² The quicker the anaphylaxis develops, the more likely the reaction will be severe and life-threatening.³

The sudden release of mast cell-, basophil-, and macrophage-derived mediators into the circulation causes pathophysiologic changes including smooth muscle contraction, increased vascular permeability, vasodilation, increased mucus secretion, and pruritus. Shock can occur rapidly and is manifested by a rapid, weak pulse, hypotension, dilated pupils, dyspnea, and possibly cyanosis. Without emergency treatment, bronchospasm, mucus plugging in the smaller airways, angioedema, and laryngeal edema can result in respiratory compromise and death.

Immediate interventions

Suspecting an anaphylactic reaction to the broad-spectrum antibiotic ampicillin, the healthcare team initiates emergency interventions. Epinephrine should be given immediately even if the diagnosis is uncertain because there are no contraindications to the use of epinephrine in this presentation.³

The nurse administers I.M. epinephrine as prescribed. Epinephrine is more rapidly absorbed when given I.M. rather than subcutaneously, producing higher plasma epinephrine levels.³ I.M. doses of epinephrine may be repeated every 5 to 15 minutes as needed. An epinephrine infusion may be needed for refractory signs and symptoms.²

The nurse administers high-flow 100% supplemental oxygen by face mask and starts a 1 L fluid bolus of 0.9% sodium chloride solution as prescribed.

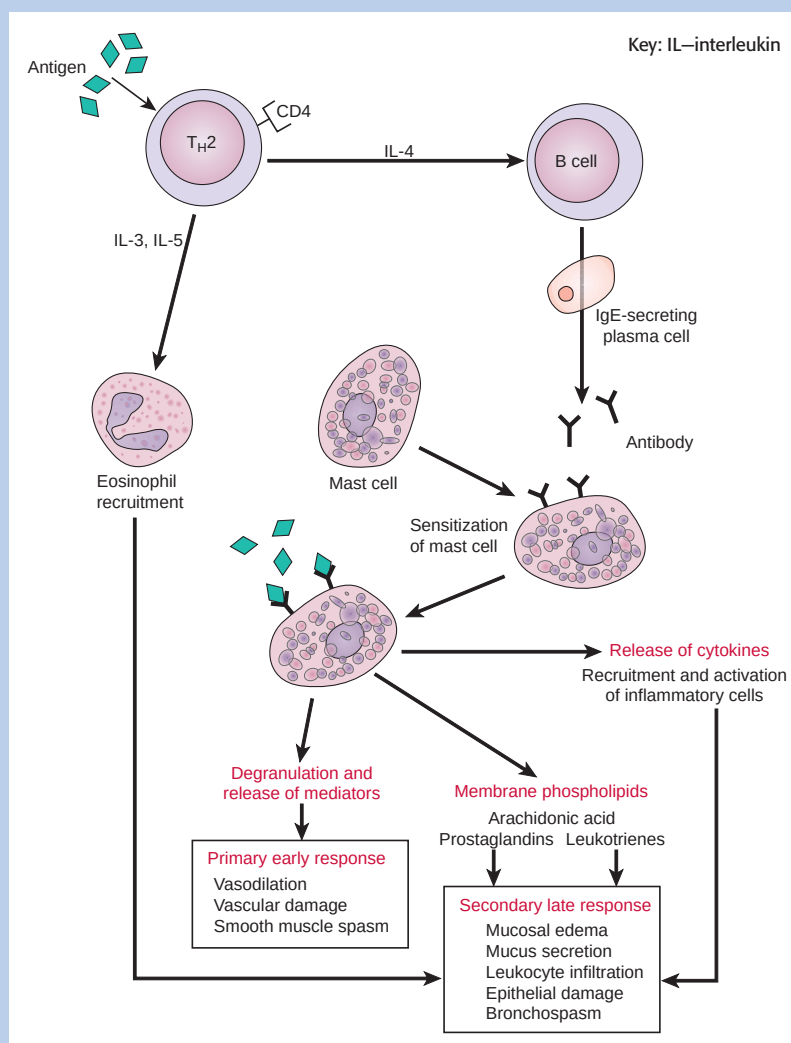
Mr. A is positioned supine with his legs elevated to support his BP. The nurse monitors his vital signs every 5 minutes.

Mr. A responds well to the initial epinephrine injection: heart rate, 120 with sinus tachycardia; respiratory rate, 28 and not as labored, suggesting

both bronchodilation and reduction of angioedema; SpO_2 96%; and BP, 90/64 supine. Mr. A's condition stabilizes and he begins to recover.

Anaphylaxis reaction

In type I, IgE-mediated hypersensitivity reaction, the stimulation of B-cell differentiation by antigen-stimulated type 2 helper T (T_H2) cells leads to plasma cell production of IgE and mast cell sensitization. Subsequent binding of the antigen produces degranulation of the sensitized mast cells with release of preformed mediators that leads to a primary, or early-phase, response. T_H2 cell recruitment of eosinophils, along with the release of cytokines and membrane phospholipids from the mast cells, leads to a secondary, or late-phase, response.



Source: Porth CM. Disorders of the immune response. In: Porth CM, ed. *Essentials of Pathophysiology*. 3rd ed. Philadelphia, PA: Wolters Kluwer Health; 2011: 347.

Ongoing care

As Mr. A continues to improve, he's continuously monitored for 6 hours. Following acute treatment, patients may experience a biphasic response as epinephrine wears off. Although the observation period should be individualized, experts recommend at least 4 to 6 hours.³ Because Mr. A responded well to the quick and effective interventions, he could be discharged from the ED in 6 hours. But, because of his left lower extremity cellulitis, he'll be admitted to a medical floor for continued treatment with a different I.V. antibiotic. Before discharge, Mr. A will be educated about cross-reacting medications that he should avoid to prevent anaphylaxis in the future and is provided with a personalized, written anaphylaxis emergency plan and a prescription for an epinephrine auto-injector. He's advised to follow up with his primary care provider and an allergist so that he can avoid future emergencies.² ■

REFERENCES:

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