

Management of Anaphylaxis



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KEYWORDS

- Anaphylaxis • Anaphylaxis management • Systemic allergic reaction • Epinephrine
- Epinephrine autoinjector

KEY POINTS

- Early recognition and treatment of anaphylaxis is essential to prevent progression to a fatal reaction. Epinephrine administered intramuscularly into the anterior lateral thigh is the drug of choice. Peak epinephrine levels are achieved more rapidly with intramuscular versus subcutaneous administration.
- Patients with anaphylaxis should be evaluated for airway, breathing, and circulation, then immediately placed in the recumbent supine position.
- The recommended dose of epinephrine to treat anaphylaxis is 0.01 mg/kg of 1 mg/mL (1:1000), not to exceed 0.5 mg/kg in a single dose. Epinephrine is commercially available in a 1 mg/mL (1:1000) vial and can be withdrawn into a syringe for administration. For epinephrine autoinjectors, use the following: for infants ≤ 10 kg, 0.1 mg; for children 10 to 25 kg, 0.15 mg; for subjects ≥ 25 kg, 0.3 mg.
- Antihistamines and glucocorticosteroids *should not* be used in the place of epinephrine. They are not helpful in the acute management of anaphylaxis. Inhalational β -2 agonists are used to treat bronchospasm associated with anaphylaxis that persists despite epinephrine administration.
- Intravenous fluids and vasopressors can be considered for patients who have refractory hypotension or shock despite optimal doses of epinephrine.

Anaphylaxis is a systemic allergic or nonallergic reaction that can lead to death. Common systemic symptoms include generalized erythema, itching and urticaria, and/or angioedema; nausea, vomiting, diarrhea, a feeling of impending doom, hypotension, and respiratory difficulty. Other symptoms may also include sneezing, rhinorrhea, nasal pruritus, and/or nasal congestion; throat clearing and/or cough; and conjunctival erythema, pruritus, or tearing. Some patients also experience a metallic taste and abdominal or uterine cramps. Acute management of anaphylaxis includes the early use of epinephrine, assessing airway function, and maintaining circulation. Long-

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Immunol Allergy Clin N Am 42 (2022) 65–76

<https://doi.org/10.1016/j.iac.2021.09.005>

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term management includes avoidance of triggers; frequent education of patients, parents, and caregivers as to how to use epinephrine autoinjectors; appropriate treatment of the cause of the reaction, for example, Hymenoptera hypersensitivity, food allergy, etc.; and referral to an allergist/immunologist. The acute management of anaphylaxis is discussed in this article.

ACUTE MANAGEMENT OF ANAPHYLAXIS

Anaphylaxis can develop rapidly and be fatal.¹⁻⁴ After exposure to a trigger, respiratory distress, cardiovascular collapse, and death may occur within minutes.¹⁻⁴ Early recognition and prompt assessment of anaphylaxis and appropriate intervention can reduce its morbidity and mortality. Recognizing and treating mild symptoms in the early phase can prevent progression to a more serious, even fatal reaction, and may prevent recurrence or biphasic anaphylaxis.^{1,5}

Generalized pruritis, erythema, and urticaria, and/or angioedema are the most common early manifestations of a systemic allergic reaction that can lead to anaphylaxis. Although these symptoms and signs are the most common presentation, they do not occur in approximately 10% of patients, that is, severe anaphylaxis may initially present without skin manifestations. It may also initially present with mild symptoms and signs, such as nausea, vomiting, without hypotension.^{1,5,6} Patients who do not have skin manifestations of anaphylaxis are at increased risk of fatality.⁷ Due to the difficulty in predicting the severity and progression of anaphylaxis, epinephrine should promptly be administered at its onset.⁸

Potential triggers should be identified and discontinued, where possible, and the patient's clinical status assessed at the earliest onset of anaphylaxis. The patient should be placed in a recumbent position and airway, breathing, and circulation should be assessed. Epinephrine is the first and most important medication and it is administered via intramuscular (IM) route into the anterior lateral mid-thigh.^{1,5,7,9-13}

Vasodilation and the increased vascular permeability associated with anaphylaxis can cause hypotension and shock. When the patient is supine, there is usually adequate blood volume to reach the heart and maintain circulation. If the patient is in the upright position, blood flow to the heart can decrease significantly, causing the "empty ventricle syndrome"^{1,11,14} or "empty heart syndrome,"¹⁵ which can lead to cardiac arrest and death.^{1,12,14}

Therefore, patients with anaphylaxis should be placed in a supine position and infants held horizontally, instead of upright or over the shoulder.¹⁶ Pregnant patients should be placed in the semirecumbent position on their left side to avoid compression of the inferior vena cava by the gravid uterus. Hemodynamic normality after anaphylaxis can take up to an hour to stabilize after a single dose of epinephrine and up to 4 hours if multiple doses of epinephrine are administered.^{1,5,9,12,14,16}

Individuals who experience respiratory distress may need to optimize their respiratory effort by remaining in the upright position. They should be closely monitored for any signs and symptoms of circulatory collapse. If there is any change in their consciousness or decrease in blood pressure, they must immediately be repositioned, as possible, into a supine position. If they become unconscious or vomit, they should be placed in the lateral recumbent position.^{5,10-12}

The Trendelenburg position is proposed in some guidelines to treat anaphylaxis to help prevent hypotension and shock by increasing blood flow to the heart.¹⁷ However, evidence for this position is limited and contradictory.^{1,5,12} The Trendelenburg position may result in decreased lung compliance, vital capacity, and tidal volume and increased respiratory effort which could be detrimental in treating anaphylaxis.¹²

Epinephrine is an alpha- and beta-adrenergic agonist and the first-line treatment of anaphylaxis. It is also administered to patients who have clinical symptoms, such as sneezing, itchy nose, runny nose, itchy eyes, and generalized erythema, pruritus, and urticaria associated with the administration of an allergen to which they may be allergic. Such reactions can evolve into anaphylaxis.^{2,8,10} Epinephrine is a life-saving drug and should be given intramuscularly into the anterior lateral mid-thigh as soon as signs and symptoms of a systemic allergic reaction are recognized.^{5,8,9,12}

It is difficult to predict which patients are at risk for progression to severe anaphylaxis when they present with signs and symptoms of a systemic allergic reaction. Therefore, epinephrine should not be withheld for these patients.^{6,8,18} Delayed epinephrine administration is associated with hospitalization and poor outcomes, that is, hypoxemia, ischemia, encephalopathy, and death.^{1,8,9,12,18,19} There is no absolute contraindication to the use of epinephrine when anaphylaxis is suspected, for the potential benefits outweigh risks, even for those at highest risk. These include elderly patients, even those with preexisting cardiovascular diseases.^{6,8,10,19,20}

The dose of epinephrine for anaphylaxis is 0.01 mg/kg of the 1 mg/mL (1:1000) concentration. It is given IM into the vastus lateralis muscle or anterior lateral mid-thigh.^{1,5,8–12} The initial dose for infants ≤ 10 kg is 0.1 mg; for those between 10 and 25 kg, 0.15 mg; and ≥ 25 kg, 0.3 mg, with a maximum of 0.5 mg for children and adults ≥ 25 kg.^{8,21} The 0.15 mg autoinjector is recommended for infants who weigh 7.5 to 10 kg when the 0.1 mg device is not available.^{8,18}

The dose can be repeated every 5 to 15 minutes, as needed, if symptoms persist.²⁰ Additional doses may be necessary for patients who have biphasic anaphylaxis, that is, anaphylaxis reoccurring 1 hour after the initial episode, for severe anaphylaxis, or protracted anaphylaxis, the latter of which persists for hours after onset.²⁰

Table 1 lists the recommended dose of epinephrine in health care settings where epinephrine autoinjectors are available.^{8,19,21} Epinephrine autoinjectors are preferred for self-administration in many health care settings due to the ease of administration. The use of autoinjectors can prevent dosing errors associated with using a syringe to withdraw epinephrine from vials or ampules.

Peak plasma epinephrine levels are achieved faster when epinephrine is given intramuscularly (8 ± 2 minutes) than subcutaneously (34 ± 14 minutes).^{1,11,18,22,23} When injected into the muscle, it causes vasodilation and increased absorption.²⁴ Locally injected epinephrine, at the site of allergen administration suspected of causing the reaction, may reduce the absorption of the allergen. An example would be a reaction caused by an injection of an allergen during allergen immunotherapy. This concept has not yet been evaluated in high-quality studies.²⁵

Intravenous (IV) epinephrine should be considered when a patient does not respond to IM epinephrine, especially with hypotension or shock.^{1,5,7,8,10,11,18,19,24} In dire circumstances, epinephrine can be administered by drawing up 1/10 of an mL of epinephrine, 1:1000, into a 1 mL tuberculin syringe, inserting it into the vein, drawing

Table 1
Dosing of epinephrine autoinjectors

Patient	Epinephrine Autoinjectors Dosing Recommendation
Infants (≤ 10 kg)	0.1 mg (If 0.1 mg dose is not available, use 0.15 mg)
Children (10–25 kg)	0.15 mg
Adolescents and Adults (≥ 25 kg)	0.3 mg

back 9/10 mL of blood, and slowly administering it intravenously.¹³ This is a 1:10,000 dilution. An example is where the patient has a rapid onset of cardiovascular collapse, not responding to IM epinephrine.

A continuous drip of IV epinephrine also can be used by mixing 1 mg (1 mL of 1:1000) of epinephrine and 1000 mL of normal saline (concentration of 1 µg/mL) and infusing it at a rate of 2 µg/min. A starting dose of 0.1 µg/kg per minute is recommended for children. The infusion is titrated to the clinical response. The rate can be increased to a maximum of 10 µg/min in adults and adolescents.^{1,12,18} Patients who are receiving IV epinephrine ultimately require continuous hemodynamic monitoring in an intensive care unit (ICU).

Alternate routes of epinephrine administration include IV bolus, epinephrine via metered-dose inhaler, and oral epinephrine. An IV bolus is not recommended as a first-line treatment due to an increased risk of arrhythmia. However, if a patient has cardiac arrest, 1 mg of IV epinephrine can be administered every 2 to 3 minutes per advanced cardiovascular life support guidelines.^{1,9,18} Epinephrine can also be administered through a metered-dose inhaler for respiratory symptoms.²³ However, this takes up to 20 to 30 inhalations over 4 minutes to be effective and does not replace IM epinephrine in treating systemic reactions.²³ Epinephrine is metabolized in the gastrointestinal tract by catechol-o-methyltransferase or monoamine oxidase, limiting its oral use for treatment.²⁴

Epinephrine acts on α -1 adrenergic receptors increasing vasoconstriction and peripheral vascular resistance. This helps reverse hypotension and decrease upper airway edema.^{8,10,11} It also acts on β -1 adrenergic receptors, increasing both cardiac inotropic and chronotropic effects and β -2 adrenergic receptors, increasing bronchodilation and reducing the release of inflammatory mediators.^{8,10,11}

Epinephrine, in recommended doses, can cause pharmacologic adverse effects including pallor, tremor, nausea, vomiting, anxiety, and palpitations.^{8,11} Severe adverse effects include ventricular arrhythmias, myocardial infarction, hypertensive crisis, and pulmonary edema. Side effects usually occur with an excessive amount of epinephrine administered by any route, in particular, by inadvertent IV administration.^{9,11} The effects of epinephrine are prolonged in patients on monoamine oxidase inhibitors, which block epinephrine metabolism. Likewise, those on tricyclic antidepressants can have prolonged action of epinephrine.²³

Airway management and oxygen supplementation are necessary for patients with severe anaphylaxis, that is, those experiencing respiratory and cardiovascular collapse despite treatment with IM epinephrine. Oxygen saturation should be maintained at 94% to 96% with high-flow oxygen administered via nasal prongs²⁶ or a face mask.^{5,9–12} An oropharyngeal airway can be used if needed.^{5,9–12}

Advanced airway management should be considered when patients develop stridor or respiratory distress consistent with upper or lower airway compromise and obstruction.^{1,7,12} Nebulized epinephrine (2–5 mL, 1 mg/mL) can be used for patients with stridor.^{5,10,15}

Patients with anaphylaxis who require intubation are frequently hemodynamically unstable. Therefore, when selecting medications for facilitating tracheal intubation, ones that lower blood pressure should be avoided, that is, fentanyl or midazolam.^{1,27} Intubation, especially in the presence of laryngeal edema or swelling of the tongue, is difficult.^{1,7,12}

IV fluids are sometimes necessary for patients with severe anaphylaxis because of a massive fluid leak and loss of intravascular volume.^{25,28} In such patients, IV normal saline or lactated Ringers via a large-bore catheter (14 or 16 gauge for adults) should be administered.^{1,5,10,12} Adults can receive a rapid infusion of 1 to 2 L of either (20 mL/kg

bolus). Likewise, children can receive IV fluid boluses of 20 mL/kg over 5 to 10 minutes and up to 30 mL/kg for the first hour.^{1,5,12} Intraosseous access is necessary if an IV route is not accessible.^{7,18}

Antihistamines have a slow onset of action and are not a first- or even second-line treatment. They reach peak plasma levels in 60 to 120 minutes when administered orally.¹⁸ Intravenously, antihistamines can take up to an hour for maximal therapeutic effect.²⁵ More often than not, clinicians administer antihistamines for cutaneous signs and symptoms of anaphylaxis, inappropriately delaying the use of epinephrine.^{12,18} Likewise, patients often are willing to take an oral antihistamine but are reluctant to self-administer epinephrine, even when they are experiencing the signs and symptoms of anaphylaxis.¹⁸ Therefore, antihistamines should only be considered when epinephrine has been appropriately used to stabilize a patient with anaphylaxis. Antihistamines can relieve generalized pruritus, flushing, and urticaria as well as angioedema. However, they do not prevent or treat cardiovascular and respiratory symptoms associated with anaphylaxis. In summary, antihistamines should not be substituted for the use of epinephrine.^{1,10–12,18} Most commonly, they may be considered following the resolution of anaphylaxis to treat persistent cutaneous symptoms, in particular, generalized pruritus and urticaria. Caution must always be used with IV administration of first-generation H1 antihistamines as they can cause hypotension.²⁹

First-generation H1 antihistamines include chlorpheniramine, dimenhydrinate, diphenhydramine, and hydroxyzine. Nonsedating second-generation H1 antihistamines include cetirizine, desloratadine, fexofenadine, levocetirizine, and loratadine.¹² The recommended dose for diphenhydramine is 25 to 50 mg in adults and 1 mg/kg to a maximum of 50 mg in children. It can be administered intravenously over 10 to 15 minutes.^{1,9,11,12} When administered orally, nonsedating second generation are preferred to sedating first-generation H1 antihistamines.^{1,12}

H2 antihistamines, cimetidine, and famotidine are often given with H1 antihistamines.¹² The recommended dose of famotidine is 20 mg by mouth or IV for adults and 0.5 mg/kg/dose in children. IV cimetidine is dosed at 4 mg/kg for adults but a pediatric dose is not established.^{1,12,30}

The role of H2 antihistamines to treat anaphylaxis is controversial. H2 and H1 receptors play a minor role in the pathophysiology of allergic reactions. H2 receptors are predominantly located in the gastrointestinal tract and less so in the vascular smooth muscle cells commonly involved in anaphylaxis.¹⁸ To the contrary, H1 receptors are widely distributed in cutaneous sensory nerves, bronchial smooth muscles, and endothelial cells. Stimulation of H1 receptors can lead to bronchoconstriction, increased vascular permeability, generalized urticaria and pruritus, and a burning sensation.³¹ Some authors suggest that the combination of H1 and H2 antihistamines may provide additional benefits over the use of just H1 antihistamines in alleviating the cutaneous symptoms of a generalized allergic reaction.^{10,11}

Inhaled short-acting bronchodilators are indicated in patients who develop bronchospasm despite epinephrine treatment. β -2 adrenergic agents, such as albuterol, can supplement the use of IM epinephrine to treat this problem. However, it should not be used in the place of epinephrine as it cannot prevent or relieve upper airway obstruction nor treat hypotension associated with anaphylaxis. Albuterol can be administered via metered-dose inhaler (2–6 inhalations) or nebulizer (2.5–5 mg in 3 mL of normal saline) and be repeated as necessary.^{1,9,10}

Glucocorticoids are inhibitors of inflammation. They bind to the glucocorticoid receptors on cell membranes and inhibit the expression of genes responsible for the synthesis of inflammatory mediators.¹⁸ They are often inappropriately used as an adjunctive treatment of systemic allergic reactions or anaphylaxis. These medications

have little effect on the symptoms or signs of anaphylaxis because of their slow onset of action, that is, 4 to 6 hours. There is minimal evidence for their use in the acute management of anaphylaxis.^{1,5,9,18} Moreover, glucocorticoids do not prevent protracted and biphasic reactions.^{1,5,6,9,18} They can be considered for use in patients with concomitant asthma or for an individual who has recently received glucocorticoid treatment and may have suppression of the hypophyseal–pituitary–adrenal axis.²⁵

Norepinephrine, vasopressin, dopamine, and other vasopressors can be used in patients who are hypotensive despite receiving optimal doses of epinephrine and volume resuscitation.^{9,11,12} These medications are used as needed but are best administered in an ICU setting with continuous hemodynamic monitoring.⁹ An epinephrine infusion can be started for individuals with unresponsive anaphylaxis. However, for persistent hypotension, dopamine or another vasopressor can be used.¹² Dopamine is an inotropic medication that has dose-dependent effects on alpha and beta-adrenergic and dopamine receptors. Dopamine is a drug of choice and also should be considered in hypotensive shock associated with low cardiac output.³² The recommended dose of dopamine is 400 mg in 500 mL of 5% dextrose; it is administered at 2 to 20 $\mu\text{g/kg/min}$ and titrated to maintain optimal blood pressure.³³ When administered at a lower dose (2–5 $\mu\text{g/kg/min}$ or more), dopamine's β -adrenergic effects increases cardiac output, stroke volume, and heart rate.³² When administered at a higher dose (5–10 $\mu\text{g/kg/min}$), dopamine acts on the α adrenergic receptors and results in vasoconstriction and increased systemic vascular resistance while maintaining renal blood flow.³² Norepinephrine and vasopressin also have been used along with epinephrine to manage anaphylaxis-induced hypotension and shock.³⁴ Norepinephrine is an α - and β -adrenergic agonist that results in increased cardiac output and vasoconstriction. It is administered at 0.05 to 0.4 $\mu\text{g/kg/min}$.³⁴ Vasopressin is ordinarily produced in the posterior pituitary gland, causes vasoconstriction, and promotes water retention.³⁴ It is dosed at 0.02 to 0.04 units/min.³⁴

The first-line treatment for patients who are on β -blockers and experiencing anaphylaxis is epinephrine. Glucagon is used in patients on β -blockers unresponsive to epinephrine and with refractory bronchospasm and hypotension.^{1,5,9,11} Patients on β -blockers seem to be at greater risk for increased severity of anaphylaxis due to β -blockade and decreased response to epinephrine.^{9,35} Epinephrine, when administered to such patients, acts unopposed on α -adrenergic receptors sometimes leading to vasoconstriction and a reflex vagotonic response.⁹ Patients who are on nonselective β -blockers also are at a higher risk for bronchospasm.¹¹ Glucagon, by increasing intracellular cAMP, directly bypasses the β -adrenergic receptors, and creates a positive chronotropic and inotropic effect on cardiac and bronchial smooth muscles.³⁶ This can counteract refractory hypotension and bronchospasm.^{1,11,12} It is dosed at 1 to 5 mg in adults (20–30 $\mu\text{g/kg}$ in children, maximum 1 mg) and administered intravenously slowly over 5 minutes and followed by an infusion of 5 to 15 $\mu\text{g/min}$ titrated to clinical response.^{1,30,33} Glucagon can induce emesis and increase the risk of aspiration. It is important to place drowsy or obtunded patients in the lateral recumbent position to maintain airway patency before glucagon administration.^{1,11,12}

PROTRACTED, BIPHASIC, AND REFRACTORY ANAPHYLAXIS

Protracted anaphylaxis is the persistence of signs and symptoms of anaphylaxis for at least 4 hours.³⁷ Treatments, such as vasopressors and ventilatory support, for more than 24 hours, may be required.³⁸ Refractory anaphylaxis is characterized by the persistence of anaphylaxis symptoms despite 3 or more doses of epinephrine and other symptom-directed treatment such as the use of IV fluids for hypotension.³⁷ IV

fluids and vasopressors may be used in refractory anaphylaxis to control and reverse hypotension.³⁹ In patients unresponsive to traditional resuscitative measures, extracorporeal membrane oxygenation may be necessary.^{1,19}

Biphasic reactions are defined by the recurrence of anaphylaxis symptoms despite no further exposure to the causative trigger beginning after ≥ 1 hour of an asymptomatic period.⁴⁰ Biphasic reactions occur in up to 20% of adults and 11% of children with anaphylaxis.^{6,18} Biphasic reactions can occur anywhere from 1 to 78 hours following the resolution of the initial reaction.¹⁷ However, most of the biphasic reactions occur 6 to 12 hours following the initial reaction.¹⁷ Epinephrine is the treatment of choice in both uniphasic and biphasic anaphylaxis.¹⁷ Biphasic and protracted reactions are 2.8 times more likely to occur if the initial onset of the reaction was more than 30 minutes after exposure to the causative allergen.⁴¹

The duration of observation in medical settings should be individualized depending on the patient characteristics and the severity of anaphylaxis, as illustrated in **Table 2**, because it is difficult to accurately predict the onset of a biphasic reaction.¹⁷ When in doubt, the patient should be admitted and observed in the hospital for up to 24 hours.^{5,9,17} **Fig. 1** is the 2021 severity grading classification for acute allergic reactions.⁴² Signs and symptoms of anaphylaxis are listed under various grades. This anaphylaxis grading system is to be used to classify patients, to help determine the duration of observation, and to communicate with other health care professionals.⁴² However, it should not be used solely to determine patient management. Regardless of the severity of anaphylaxis, epinephrine is always the drug of choice.

All patients who experience anaphylaxis should be educated about the signs and symptoms of anaphylaxis, risks of recurrence, and allergen avoidance. They should be provided with a personalized anaphylaxis emergency action plan and epinephrine autoinjectors with appropriate instructions on their use. All patients with anaphylaxis should be referred to an allergist/immunologist for further evaluation and long-term management.^{1,5,12,17}

Long-term management is essential to prevent the recurrence of the event and to prevent more serious reactions and fatality. Such management includes avoidance of allergens; identification and elimination, where possible, of cofactors which may increase susceptibility to such a reaction; interventions to reduce sensitivity, for

Table 2
Recommended observation time for anaphylaxis

Duration of Observation	Clinical Features
1 h	Patients who remain asymptomatic <i>and</i> have resolved mild anaphylaxis with the following characteristics: • Have low risk for anaphylaxis • Have no significant comorbidities or limitations such as severe asthma, cardiovascular disease, lack of access to epinephrine, lack of access to medical care, and poor self-management skills • Have a favorable response to a single dose of epinephrine
Up to 6 h or longer (including hospital admission)	Patients who have severe clinical features or have other comorbidities/risk factors such as: • Hypotension and/or respiratory distress • Coexisting medical comorbidities • Inability to access medical care • Required more than 1 dose of epinephrine

Although medical identification may be important to identify and treat anaphylaxis, the wording on the jewelry is not reviewed by experts who treat it.⁴³ Patients are responsible for what is contained on their medical identification which possibly decreases the accuracy and relevance of the data included.⁴³ Physicians and other health care professionals should discuss the information that should be indicated on medical identification jewelry and/or products.

SUMMARY

Early recognition, assessment, and management of anaphylaxis are essential to reduce associated morbidity and mortality. Epinephrine is the treatment of choice. It is administered at a dose of 0.01 mg/kg of 1 mg/mL (1:1000) concentration intramuscularly into the anterior lateral thigh. For infants ≤ 10 kg, clinicians should consider a 0.1 mg epinephrine autoinjector, if available; for those between 10 and 25 kg, 0.15 mg; and for individuals who weigh ≥ 25 kg, 0.3 mg. Delayed epinephrine injection is associated with increased risk for fatality. Patients with mild anaphylaxis should be observed for at least an hour and those with more severe features should be observed for up to 6 hours or more. For patients who develop refractory hypotension or bronchospasm, despite adequate and optimal epinephrine treatment, other measures should be considered including IV fluid resuscitation, inhalation β -2 agonist administration, glucagon infusion if on a β -blocker, and a vasopressor for hypotension. Ideally, the latter, when possible, should be performed in an ICU setting with continuous hemodynamic monitoring under the care of a critical care specialist.

All patients with anaphylaxis should be referred to an allergist/immunologist for further evaluation and long-term management. On discharge, instructions on allergen/trigger avoidance, an anaphylaxis emergency treatment plan, and education on the use of an epinephrine autoinjector should be provided.

CLINICS CARE POINTS

- For individuals with anaphylaxis, first-line treatment is epinephrine. Consider the following appropriate doses based on weight and autoinjector availability.
 - Epinephrine dosing is 0.01 mg/kg of the 1 mg/mL (1:1000) concentration and is given intramuscularly to the lateral mid-thigh.
 - For infants less than or equal to 10 kg, consider 0.1mg by autoinjector if available or 0.15mg by autoinjector
 - For children between 10 to 25 kg, 0.15 mg
 - For adolescents and adults greater than or equal to 25 kg, 0.3 mg
- Glucocorticoids have not been shown to prevent protracted and biphasic anaphylactic reactions.
- Antihistamines and glucocorticoids should not replace epinephrine. They are not helpful in the acute management of anaphylaxis.
- Inhaled short-acting β -2 adrenergic agonists are used to treat bronchospasm associated with anaphylaxis that persists despite epinephrine administration.
 - β -2 adrenergic agonists cannot prevent or relieve upper airway obstruction.
- Patients on β -blockers with anaphylaxis should be treated first with epinephrine. Glucagon is used in patients on B-blockers unresponsive to epinephrine and with refractory bronchospasm and hypotension.
- Patients with mild anaphylaxis should be observed for an hour and those with severe features should be observed for 6 or more hours.

- Referral to allergist should be provided when necessary.
- Patients should be provided with information regarding medical identification and clinicians should discuss appropriate wording to communicate relevant and important information.

DISCLOSURE

The authors have nothing to disclose.

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