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Review Article

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Evaluation of Diagnosis and Management of Anaphylactic shock in Emergency Room: A Literature Review

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ABSTRACT

Background: *Anaphylaxis is the most severe form of an allergic reaction. The incidence rate of anaphylaxis enhanced during the last decade. Death may happen in fatal anaphylactic shocks within minutes of the reaction. Hence, it is needed to highlight the significance of effective emergency management.* ***Objective:*** *In this investigation, we aimed to discuss the important aspects of anaphylaxis shock diagnosis and management in the emergency room.* ***Method:*** *PubMed database was used for article selection, and the following keywords were used in the mesh: "anaphylaxis management in emergency room"[Mesh] and "anaphylactic shock management in emergency room"[Mesh]. A total of 20 papers were reviewed and included in the research.* ***Conclusion:*** *The essential manifestations of anaphylactic reactions are on the skin, in the gastrointestinal tract, respiratory tract, and cardiovascular system. The symptoms may begin and progress very quickly, in which the condition can deteriorate dramatically into death within a few minutes. Then, a physician should be skilled and prepared for such cases. The most noteworthy drug in the acute remedy of anaphylaxis is adrenaline as it is a lifesaving drug in cases of anaphylaxis.*

Key words: *Anaphylactic Shock, Diagnosis, Management, Emergency.*

INTRODUCTION

Anaphylaxis is the most severe form of an allergic reaction. It is a life-threatening, systemic hypersensitivity response to a specific allergen [1]. The incidence rate of anaphylaxis has enhanced in the recent decade. It can be caused by many substances such as some drugs [2]. Investigations have revealed that many patients who present to the emergency room (ER) with anaphylaxis are misdiagnosed. Physicians mostly face difficulty in diagnosing

anaphylaxis due to its vague presentation and differing symptoms. Also, the onset of symptoms and suspected allergens are usually unknown. In addition, there is a difficulty in predicting the severity of a reaction. Death may happen in fatal anaphylactic shocks within minutes of the reaction. Hence, it is essential to emphasize the importance of efficient emergency management [1, 3, 4]. In this review, we tried to review the literature that discussed the management of anaphylaxis.

METHODOLOGY

PubMed database was used for article selection, and the following keywords were used in the mesh: "anaphylaxis management in emergency room"[Mesh] and "anaphylactic shock management in emergency room"[Mesh]. A total of 20 papers were reviewed and included in the research. The articles were chosen according to the relevance to the project including anaphylaxis management in the emergency room. Exclusion criteria were all other articles that did not have a related aspect to the emergency management of anaphylaxis as their primary endpoint or repeated researches.

DISCUSSION

Anaphylaxis is considered as a serious allergic reaction, which has a fast onset and can be lethal [5]. The onset of anaphylaxis can be rapid which necessitates a quick intervention to provide definitive treatment in order to stabilize the patient's condition [6]. This phenomenon is old and it has been mentioned in the ancient medical literature of Greece and China. As hieroglyphs tell, pharaoh Menes died 2640 BC from a wasp sting. He might be the first documented anaphylactic patient [7].

At the beginning of the 20th century, Charles Richet and Paul Portier examined the dogs by immunizing them with Actinia extracts. After repeated injections, a dog died in dramatic circumstances. Richet recognized this new phenomenon and named it "anaphylaxis" [7]. Then, Richet received the Nobel Prize in 1913 for its explanation. The recognition of this phenomenon led later to the appearance of the word 'allergy' which was created by Clemens Freiherr von Pirquet in 1906 [7]. Later, similar manifestations had been seen by researchers on some individuals after histamine injection, particularly on those who are not previously sensitized [8, 9].

In recent years, the anaphylaxis incidence rate has increased [1]. The enhancement in Australia during the last 10 years may reach to 350% for food-induced anaphylaxis and to 230% for non-food-induced anaphylaxis [10]. In England and Wales, hospital admissions from anaphylaxis enhanced by 615% over the 10-year examination period between 1992 and 2012 [11]. Nevertheless, mortality rates from anaphylaxis stayed the same. The most prevalent cause of anaphylaxis is food. Age is a notable factor influencing the etiology of anaphylaxis [12, 13].

Pathophysiology:

Anaphylaxis pathophysiology can be manifested as a type of vasogenic shock. It has a range of presentations from mild symptoms to acute respiratory distress and/or circulatory shock and collapse. When the patient gets exposed to an allergen, IgE antibodies are generated. IgE antibodies bind to basophils and mast cells [14, 15]. After re-exposure to the allergen, Type I hypersensitivity reaction begins and the IgE antibodies make the mast cells and basophils to release the inflammatory mediators such as BK-A, histamine, leukotrienes, and platelet-activating factor. These inflammatory mediators are what cause the anaphylactic manifestations in the body. Symptoms usually occur in 20 to 30 minutes [16]. Histamine and other substances cause systemic vasodilation, which increases capillary permeability. This leads to peripheral and visceral edema that subsequently produces hypovolemia and shock. Because of vasodilation and thus the decrease of systemic vascular resistance, the blood pressure dramatically decreases in a very short span of time [6].

Along with the vascular complications of anaphylaxis, respiratory complications may occur. Due to the edema of the airway, airway constriction, bronchospasm, and angioedema may manifest. Upper airway obstruction can result from the angioedema of the pharynx, larynx, and trachea. In addition, bronchospasm and mucosal edema lead to lower airway obstruction. Death regularly happens because of asphyxiation and/or sometimes due to circulatory shock [6]. The most prevalent triggers are insect stings, food, and medications [17, 18]. Food-related reactions are more prevalent in children particularly less than four years of age while medication reactions are more prevalent in patients older than 55 years [19].

The possible anaphylaxis triggers are allergy testing, allergy-specific immunotherapy, animal dander, foods such as egg, fish, shellfish, peanuts, milk, and tree nuts. Other common triggers are insect venom and stinging insects

from the Hymenoptera order like bees and wasps. The medications that can induce anaphylaxis are angiotensin-converting enzyme inhibitors, antibiotics (most commonly β-lactams), aspirin, allopurinol, and nonsteroidal anti-inflammatory drugs [19].

Clinical picture:

The essential manifestations of anaphylactic reactions are in the respiratory tract, cardiovascular system, gastrointestinal tract, and on the skin [20]. The symptoms may begin and progress very quickly, in which the condition can deteriorate dramatically into death within a few minutes. The symptoms may appear either simultaneously or sequentially. Sometimes, circulatory reactions may primarily appear before cutaneous or respiratory signs [21]. Generally, minor prodromal signs or symptoms will appear first such as itching in the palms and soles or sometimes in the genital area. Other less common symptoms are headache, metallic taste, fearfulness, or disorientation. In young children, these feelings cannot be expressed but symptoms of restlessness or withdrawal behavior can be observed before the onset of objective signs. Cutaneous and mucous membranes manifestations of anaphylaxis may present with pruritus, erythema, urticaria, and angioedema (Quincke's edema) [20].

In the upper respiratory tract, patients frequently experience burning and itching of the tongue or palate as primary symptoms and the tongue can be swollen as well. Clinical signs are a muffled voice, with probable dysphagia and sometimes stridor. The expected life-threatening complications of laryngeal edema could be airway obstruction with hypoxia. Unfortunately, they can develop in a short period of time [20].

Bronchoconstriction and dyspnea may develop especially in patients with asthma. Clinical signs are increased respiratory rate and wheezing. The severity of the anaphylactic reaction is directly affected by the degree of asthma in the individual. Extensive vasoconstriction may occur as well, which may lead to increased pulmonary vascular resistance as well as respiratory arrest and the need for resuscitation. Moreover, one of the possible complications of this permeability is pulmonary edema [22].

The abdomen may experience complications as well, such as abdominal pain, cramps, nausea, vomiting, and diarrhea. They sometimes can be accompanied by increased intestinal motility in which induce the urge to defecate and may cause involuntary defecation. Hypotension can be experienced in anaphylactic patients due to vasodilatation and increased vascular permeability. Similarly, the fluid loss into the extravascular space happens resultingly in hypovolemia and hemoconcentration. This will be followed by tachycardia along with the arterial hypotension. Moreover, direct cardiac symptoms may eventually occur such as arrhythmia, bradycardia or myocardial infarction [20]. Central nervous system symptoms include a headache, restlessness, seizures, and altered level or loss of consciousness. In children, behavioral changes are often observed, expressed by anxiety or sometimes aggression [20].

The cause of death in cases of anaphylaxis is mostly due to airway obstruction. Furthermore, cardiovascular failure is a common cause because of direct heart involvement or as a complication of the microcirculatory dysfunction with shock. Rare causes of fatal anaphylaxis comprise of adrenaline overdose and disseminated intravascular coagulation [22].

Management:

An immediate assessment utilizing an airway, disability, circulation, breathing, and exposure approach is the primary step in a patient with anaphylaxis. Adrenaline always must be given first. Patient must stay in a flat position and must not stand or walk. Then, if an allergen still presents, it should be removed, for example, insect stings should be flicked out, and ticks should be frozen with liquid nitrogen or ether-containing spray and allowed to drop off. Then, bronchodilators should be given to the patient who is experiencing breathing difficulty, especially in patients with known asthma or allergy to food, insects, or medicine. Continuous monitoring of the pulse, oxygen saturation, blood pressure, and respiratory rate is recommended. Oxygen and airway support are very important. In hypotensive patients, intravenous access must be obtained and intravenous normal saline 20 mL/kg must be given rapidly [23].

- **Adrenaline**

Adrenaline mainly works on α-1 receptors. This causes peripheral vasoconstriction which will reverse the hypotension and mucosal edema. Adrenaline also affects β-1 receptors leading to increasing both the rate and force of cardiac contractions thereby reversing hypotension and β-2 receptors which reverses bronchoconstriction

and reduces inflammatory mediators released [24]. Thus, Adrenaline must be administered as it has the ability to save the lives of all patients experiencing anaphylaxis. It should also be administered to those with clinical characteristics that are likely to evolve into anaphylaxis [25, 26]. In anaphylaxis patients, there are no known contraindications to adrenaline treatment. However, in cases of elderly patients and patients with known cardiovascular illness, the advantages of administering adrenaline always outweigh the risks [27].

Adrenaline must be injected intramuscularly into the mid-outer thigh [28, 29]. Despite some patients can experience adverse influences such as transient pallor, palpitations, and a headache, the administration of adrenaline intramuscularly is considered harmless. Intramuscular adrenaline should be administered at a dose of 0.01 ml/kg of body weight to a maximum total dose of 0.5 ml [30]. In cases when adrenaline auto-injectors are being utilized, patients weighing between 7.5 and 25 kg should receive 0.15 mg dose with patients being moved to 0.3 mg dose at 25 to 30 kg. The dose can be repeated after at least a 5-minute interval [23].

If repeated intramuscular doses of adrenaline did not show any improvement, adrenaline infusion can be more beneficial. Nevertheless, in patients with suitable circulation, intravenous adrenaline may result in life-threatening adverse effects such as severe hypertension or arrhythmias. Therefore, it is recommended that intravenous adrenaline should be reserved for refractory cases only. In addition, experienced doctors in the use of vasopressors such as anesthetists and critical care unit doctors must give adrenaline. Continuing the checking of the heart rate, oxygen saturation, blood pressure as well as ECG is suggested for these patients [23, 31].

- **Posture**

The patient mostly should be maintained in a flat position and must not stand or walk. However, in some cases, the patient should be positioned accordingly. In patients presenting with respiratory distress, the recommended position is sitting up. In cases of circulatory instability, the patient is recommended to be positioned lying on back with the lower extremities elevated in order to conserve the circulatory volume. Pregnant patients should be placed semi-recumbent on the left side with lower extremities elevated [30, 32].

- **Oxygen**

High flow oxygen should be administered by facemask to all anaphylaxis patients aiming for a saturation above 92%.

- **Fluid support**

In patients with cardiovascular instability, intravenous fluids should be administered. Normal saline is the fluid of choice and should be given 20 ml/kg bolus.

- **Inhaled short-acting β-2-agonists**

Patients with anaphylaxis may develop symptoms of bronchoconstriction. Therefore, inhaled short-acting β-2 agonists can be given to relieve symptoms [31]. Even after administrating adrenaline and resolution of symptoms, mild wheeze should be treated with inhaled short-acting β-2 agonists.

- **H1- and H2-antihistamines**

As mentioned earlier, histamine is the main inflammatory mediator released in anaphylaxis. Therefore, systemic antihistamines are used commonly in anaphylaxis cases. Antihistamines mainly relieve cutaneous symptoms of anaphylaxis. Moreover, combining systemic H1- and H2-antihistamines showed higher efficacy in treating cutaneous manifestations especially in patients who developed acute allergic reactions [31].

- **Glucocorticosteroids**

Glucocorticosteroids are supposed to be an effective therapy in asthmatic patients presented with anaphylaxis. Oral or parenteral glucocorticosteroids are advised to be given after the initial therapies have been administered [6].

CONCLUSION

The key manifestations of anaphylactic reactions are on the skin, in the respiratory tract, gastrointestinal tract, and cardiovascular system. The symptoms may begin and progress very quickly, in which the condition can deteriorate dramatically into death within a few minutes. Therefore, the physician should be educated and prepared for such

cases. The most important drug in the acute therapy of anaphylaxis is adrenaline because it is the lifesaving drug in cases of anaphylaxis. Intravenous fluids are very important in treating anaphylaxis especially in cases of hypotension or cardiovascular instability. Antihistamines and glucocorticosteroids are also considered safe and effective options in treating the symptoms of anaphylaxis.

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