

How incorrect is the use of adrenaline auto-injectors?

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Anaphylaxis is defined as a severe allergic reaction that is rapid in onset and can be fatal. Although this definition is currently the most widely used, it is not universally accepted. The lack of consensus, together with the severity of the clinical symptoms, hampers diagnosis, appropriate management in the emergency department (ED), and identification of the trigger. Several recent studies have attempted to establish the incidence of anaphylaxis in the ED. The studies are mostly based on database searches, which reveal incidence rates of 0.07–0.4 %. Studies on the epidemiology of anaphylaxis are hampered by limited diagnostic criteria and underreporting of the condition by health professionals, which is favored by the lack of a universally accepted clinical definition. In one study, the cumulative incidence of anaphylaxis was determined by allergists after analyzing the medical records of all patients who presented to the ED [1]. The incidence of anaphylaxis is 0.08 %, which lies within the range of values for the ED established elsewhere. However, if we take into account only patients from the Internal Medicine Department, the incidence is 0.13 %.

Intramuscular epinephrine is the first-line treatment for anaphylaxis, as recommended in all modern guidelines, including the recent Cochrane Library review [2]. Accurate recognition of anaphylaxis makes for better management of acute episodes. Patients who have been diagnosed with anaphylaxis in the ED receive epinephrine more often than

those without that specific diagnosis, regardless of the severity of their symptoms. Epinephrine was administered to 39.7 %, and only in one-third of these patients was the injection intramuscular. Evidence has shown that delayed epinephrine injection is associated with mortality. Nevertheless, and despite the proliferation of guidelines for the management of anaphylaxis during recent years, epinephrine is still rarely used in clinical practice. In many cases, patients with anaphylaxis do not receive optimal treatment [3].

As emergency medical devices, an adrenaline auto-injector (AAI) should be simple to use; however, cross-sectional surveys suggest that patients, their parents and even healthcare practitioners are unable to use commonly prescribed AAI. These findings may be due to a lack of adequate training, or to inherent flaws in AAI device design. Previous work has shown patients commonly misuse AAI. It is unclear whether this is due to inadequate training, or poor device design. In a prospective randomized controlled trial to evaluate ability to administer adrenaline using different AAI devices (Anapen™, EpiPen™, JEXT™, or a device with audio prompts Auvi-Q™), participants did not receive any specific training with the new device, but were asked to use it in a simulated anaphylaxis scenario [4]. In contrast to previous work, these data demonstrate that AAI device design, not simply AAI training, is critical for successful adrenaline delivery in an emergency scenario. In this study, all participants were optimally trained, and were able to successfully administer adrenaline using a trainer AAI at the end of the initial training session. The high rate of successful adrenaline administration (93 %), which we found when participants used the audio-prompt device Auvi-Q in a stressful anaphylaxis scenario and without prior device-specific training, suggests that Auvi-Q is an important advance in AAI device design, and may play a similar role to automated external defibrillators with

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audiovisual cues, which are currently used for bystander treatment of cardiac arrest.

Physicians generally agree that epinephrine auto-injectors should be prescribed for patients with a history of upper or lower respiratory symptoms, hypotension, or shock in anaphylaxis, those with a history of anaphylaxis from certain triggers including foods, insect stings or exercise, and those with idiopathic anaphylaxis. Most anaphylaxis guidelines recommend injecting it from an auto-injector intramuscularly in the mid-anterolateral aspect of the thigh. The correct use of epinephrine, the cornerstone of emergency preparedness anaphylaxis education about when, why, and how to use an epinephrine auto-injector, remains critically important. Healthcare professionals need to be trained to use epinephrine auto-injectors to train those at risk for anaphylaxis and their caregivers on how to use them correctly and safely [5]. Epinephrine auto-injectors should be prescribed along with a personalized anaphylaxis emergency action plan that lists common signs and symptoms of anaphylaxis, and instructs the patient to inject epinephrine promptly, then call emergency medical services or go to an ED. Many different anaphylaxis emergency action plans are in use [6, 7]. An important aspect of long-term risk reduction in anaphylaxis involves follow-up of the patient at regular intervals. Such visits should include reassessment of the patient's ability to use an epinephrine auto-injector correctly, and coaching with regard to any improvements needed. These follow-up visits also offer the opportunity to improve the management of comorbidities or concurrent medications, and an opportunity to review strategies for avoidance of allergen triggers [5].

A single allergy education session targeting school nurses, increased the availability of epinephrine to children with food allergies, and this effect was sustained over 2 years [8]. Patients of lower socioeconomic status experience many factors that limit their access to medical care. Despite these factors, a single school nurse educational intervention was equally effective in low and non-low socioeconomic schools. This single educational session made a dramatic and sustainable impact on the availability of lifesaving epinephrine in a large urban school district.

Ridoldo et al. [9] present one study that investigated the proper use of adrenaline auto-injectors in a real-life population of adolescent and adult patients at risk of anaphylaxis, who were already prescribed and trained in the correct use of the adrenaline auto-injector by allergists. The assessment was made during a routine follow-up visit that patients underwent at regular intervals. Despite all patients being trained in the administration of the adrenaline auto-injector at the time of the first prescription and during subsequent follow-up visits, only 39 % could demonstrate a correct use of the device, while most patients could not simulate the administration in a fully correct manner. This is a serious concern since they would not be able to successfully manage a life-threatening allergic reaction in

the community setting. This suggests the need to reinforce patients' educations. Providing a written and visual instruction sheet for each trainer device is also effective in increasing its correct use and decreasing common errors by untrained users. The factor most closely related to proper use of the device is the education of the patient, while age and the time from first prescription do not affect the ability to properly use the auto-injector. Even though accurate training is conducted, many patients are still unable to properly use the adrenaline auto-injector in case of anaphylaxis. Allergists should review the instructions provided to the patient every time a renewal of the auto-injector is prescribed. Primary care physicians and other healthcare workers like pharmacists should also be actively involved in the education of patients at risk of anaphylaxis.

Compliance with ethical statements

Conflict of interest The author declare he has no conflict of interest.

Statement of human and animal rights All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed consent For this type of study formal consent is not required.

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