



London Health Sciences Centre

Southwest Ontario Regional Base Hospital Program

Primary Care Paramedic

Diphenhydramine

(Benadryl)

Certification Package

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Introduction & Expectations

Welcome to the Diphenhydramine Certification package! The addition of Benadryl to your list of medications provides added opportunities for the treatment of allergic reactions.

This self-study learning package has been developed in order to help prepare you for this new skill. It reviews the basics of an allergic reaction, the pharmacology of Diphenhydramine, and the treatment of these patients according to the BLS Patient Care Standards (page 2-14) and the Provincial Medical Directives.

In addition to the reading material, paramedics are encouraged to visit our website at www.lhsc.on.ca/bhp for an electronic copy of this Learner Package, the associated Webinar, the Provincial Medical Directives as well as many other educational resources.

At the completion of the self-study time, paramedics will complete a written evaluation that will be submitted to the Base Hospital for marking and review. Paramedics will be notified of the results and receive confirmation of their certification for Benadryl use. Implementation of the new treatment will be coordinated through your EMS service.

If you have any questions, feel free to contact us at the Southwest Ontario Regional Base Hospital Program at any time.

Learning Objectives

Given a pre-recorded Webinar Presentation, the Provincial Medical Directives, and a self-study Learner Package, the Paramedic will be able to:

- Explain the etiology and pathophysiology of an allergic reaction,
- Describe the basic pharmacology of Diphenhydramine,
- Calculate the appropriate dosage of Diphenhydramine for patients suffering from an allergic reaction,
- Describe and demonstrate the proper application of the *Anaphylaxis/Allergic Reaction Protocol (ACP & PCP)*,

As evaluated by a written evaluation (80% passing grade).

Etiology & Pathophysiology of an Allergic Reaction

An allergic reaction is defined as an exaggerated immune system response to a foreign substance, and compared to an anaphylactic reaction is far less severe. An anaphylactic reaction is an altered immunological reaction due to hypersensitivity to a foreign substance, and is life threatening. An allergic or anaphylactic reaction is initiated by the body's exposure to an antigen (allergen) – ex. a bee sting, medication or food. Bock, SA., Munoz-Furlong, A., and Sampson, HA. (2001), found that upon exposure to an antigen, 63% of fatal anaphylactic reactions were due to a severe allergy to peanuts, followed closely by other nuts (31%) and the remainder from milk and fish allergies. The majority of individuals who suffer anaphylactic reactions are adolescents or young adults and are well aware of their allergies having had previous exposure and reaction to an allergen (Macdougall, Cant & Colver, 2001). There is no difference between the incidences of males versus females with anaphylactic reactions. It is notable that of those who suffer these types of reactions, many also suffer from asthma (Bock, Munoz-Furlong, & Sampson, 2001).

When the body is exposed to an antigen, the antigen is recognized by lymphocytes (white blood cells involved in the immune response) as foreign, and initiates a cascade of events. The lymphocytes mature into either B lymphocytes (produce antibodies responsible for neutralizing antigens) or T lymphocytes (interact directly with the antigen to either neutralize or destroy it). This is categorized as the primary response, or sensitization phase. If the body is reintroduced to the same or similar antigen, the secondary response is much faster and more pronounced. The antibodies released during an allergic reaction attach themselves to the membranes of basophils and mast cells (white blood cells), causing them to release large amounts of histamine and leukotrienes into the surrounding tissues.

Histamine is a potent defensive chemical mediator that has the ability to cause bronchoconstriction, increased gastrointestinal motility, peripheral vasodilation and the secretion of gastric acids. Histamine also causes vascular permeability, allowing the movement of fluid from the circulatory system into the surrounding tissue. Leukotrienes are very potent bronchoconstrictors, and can also cause coronary vasoconstriction and increased vascular permeability. The effects of leukotrienes are delayed slightly (relative to histamine) and have a much longer duration of action. It is for this reason that delayed wheezing may occur in a patient with an anaphylactic reaction, therefore requiring Salbutamol administration.

The above mentioned mechanisms are in place to attempt to minimize the body's exposure to the antigen, and in a severe allergic reaction are excessive. The protective mechanism of bronchoconstriction decreases the possibility of the antigen moving through the respiratory tract, increased GI motility moves the antigen quickly along the GI tract for minimal absorption, and finally vasodilation and increased permeability remove the antigen from the blood stream where it has the ability to do the most damage (Sanders, 2007). The degree to which each of these mechanisms affect the patient will determine whether the person is suffering a mild, moderate or severe allergic reaction.

Signs and symptoms associated with a mild reaction may include urticaria (hives) and pruritus (itchiness). A severe or anaphylactic reaction may include laryngeal edema, bronchoconstriction, tachycardia, hypotension, decreasing LOA, nausea, vomiting, and diarrhea. In the cases of anaphylactic reactions, Epinephrine (possibly along with Diphenhydramine and Salbutamol) is the medication of choice to attempt to reverse the effects of the reaction. In less severe, non-life threatening allergic reactions, Diphenhydramine may be the medication of choice to alleviate the discomfort felt as a result of the exposure to the allergen. Any patient who receives Epinephrine for a suspected anaphylactic reaction should also receive Benadryl to prevent any vasodilatory effects should they arise following the patient's current signs and symptoms.

Pharmacology of Diphenhydramine

Diphenhydramine is the medication of choice when treating the signs and symptoms of a mild or moderate allergic reaction, or in conjunction with Epinephrine/Salbutamol in the treatment of a severe or anaphylactic reaction. Diphenhydramine is a first generation H1 receptor antagonist, meaning that it competes for H1 receptor sites on cell and tissue membranes. This prevents histamine from binding to receptor sites on tissues, and therefore prevents or minimizes the multitude of signs and symptoms associated with an allergic reaction (Simons, Watson, Martin, Chen & Simons, 1990). Diphenhydramine is also anticholinergic as it also binds to muscarinic cholinergic receptor sites (Mycek, Harvey & Champe, 1997). The effects of Diphenhydramine binding to H1 and muscarinic cholinergic receptor sites are the reversal of vasodilation, hypotension and tachycardia. The reversal of vasodilation will attempt to maintain adequate blood volume and therefore blood pressure. The increase in blood pressure will then relieve the need for an increased heart rate (compensation for decreased blood volume and therefore decreased circulating oxygen) and reduce tachycardia.

When administering any medication to a patient, the Paramedic must be aware that the medication they are providing may interfere with other medications the patient may be taking. For example, potentiation may occur when two medications are taken together and the effects of one intensify the effects of the other. Synergism may also occur when administering two medications with similar actions on the body. If Diphenhydramine and another anticholinergic or antihistamine were administered simultaneously, there is a chance that the combined effect would be greater than the effect of the two medications taken independently. Finally, an additive effect may also occur when administering two medications at the same time. The additive effect is where the action of one medication plus the action of another medication results in an effect that is representative of one single medication.

Administration of Diphenhydramine is via IM injection, or IV access. When administered via IV, Diphenhydramine does not need to be diluted with Normal Saline, but should be pushed slowly. The onset of Diphenhydramine is 15-30 minutes, and its duration is anywhere between 3 and 12 hours. The most frequently reported side effects of Diphenhydramine administration are sedation, dizziness, and nausea; therefore all patients

receiving this medication should be informed in advance of these potential complications (CPS, 2009; Simons et al., 1990). Although rare, an allergy to Diphenhydramine would prevent its administration. It is always important to gather as much medical history as possible before administration of any medication; including any past medical problems, medications and allergies. Paramedics must be aware not only of the potential complications, but also the mechanisms of pharmacology stated above. For the indications, dosage and appropriate management and treatment of patients suffering from allergic reactions, refer to the current *Anaphylaxis/Allergic Reaction Protocol (ACP & PCP)*.

Summary

An allergic reaction is an exaggerated immune system response to a foreign substance. When the body is initially exposed to an antigen, the antigen is recognized by lymphocytes initiating a cascade of events in an attempt to neutralize or destroy it. If the body is reintroduced to the same or similar antigen, the antibodies released cause the release of histamine which then causes varying degrees of bronchoconstriction, increased gastrointestinal motility, peripheral vasodilation, increased vascular permeability and the secretion of gastric acids. Diphenhydramine is the medication of choice to alleviate the discomfort felt as a result of exposure to an allergen whether there is a mild, moderate or severe reaction. Diphenhydramine is an H1 receptor antagonist and anticholinergic meaning that it competes for H1 receptor sites and muscarinic cholinergic receptor sites in an attempt to reverse vasodilation, hypotension and tachycardia. Administering any medication however, carries risks that Paramedics must be aware of, and must communicate them with the patient. Diphenhydramine has the ability to dramatically decrease the discomfort for a patient suffering from a mild or moderate allergic reaction and can be used in conjunction with Epinephrine/Salbutamol for anaphylactic reactions.

References

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