London Health Sciences Centre
Southwest Ontario Regional Base Hospital Program

Primary Care Paramedic

Dimenhydrinate

(Gravol)

Certification Package

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Introduction & Expectations

Welcome to the Dimenhydrinate Certification package! The addition of Gravol to your list of medications provides added opportunities for the treatment of nausea and vomiting.

This self-study learning package has been developed in order to help prepare you for this new skill. It reviews the basics of the vomiting center, the causes and effects of nausea and vomiting, and the treatment of these patients according to the BLS Patient Care Standards (page 2-35) 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 Gravol 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 nausea and vomiting in the adult,
- Describe the basic pharmacology of Dimenhydrinate,
- Calculate the appropriate dosage of Dimenhydrinate for patients suffering from nausea and vomiting,
- Describe and demonstrate the proper application of the *Auxiliary Nausea & Vomiting Protocol (ACP & PCP)*,

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

Etiology & Pathophysiology of Nausea & Vomiting

Nausea and vomiting are common complications of multiple conditions, procedures, and therapies, and adversely affect the quality of life in a large population (Flake, Scalley & Bailey, 2004). Nausea is described as the subjective symptom characterized by the patient's report of an unpleasant sensation in the back of the throat, diaphoresis, dizziness, chills, and excess salivation which usually precedes vomiting. Vomiting is the forceful expulsion of stomach contents through the mouth due to contraction of the abdominal muscles (Cranwell-Bruce, 2009). This complex act of vomiting requires strict coordination of the respiratory, gastrointestinal and abdominal musculature and is controlled by the emetic centre in the brain. This coordination of systems induces significant changes in the body with the ultimate goal of expelling vomitus. An increase in intrathoracic and intragastric pressure, contraction of the rectus abdominis, external oblique and anterior abdominal muscles, along with relaxation of the esophageal sphincter and reverse peristalsis result in the expulsion of stomach contents (Watcha & White, 1992).

Nausea and vomiting are important defense mechanisms against the ingestion or presence of toxins, irritation, or over distension, however, when excessive may lead to serious health problems. Persistent vomiting may result in dehydration and electrolyte imbalance, or for post-operative patients; hypertension, bleeding, aspiration, delayed discharge and potential strain on suture lines (Watcha & White, 1992). Both the sensation and action of nausea and vomiting are caused by complex interactions between the gastrointestinal system, the vestibular system (sensory system that controls the sense of movement and balance), and various parts of the brain (Wilhelm, Dehoorne-Smith & Kale-Pradhan, 2007).

There are several physiologic causes of nausea and vomiting. Firstly, direct stimulation of the vomiting centre in the medulla. The medulla is the lowest portion of the brainstem and controls vital functions. It contains the cardiac centre, respiratory centre and vasomotor centre and is responsible for maintenance of heart rate, vasomotor tone, respiration, and swallowing. The second cause of nausea and vomiting is stimulation of the chemoreceptor trigger zone (CTZ), which is also found in the medulla. The CTZ receives input from blood borne stimuli; for example, drugs and hormones, and communicates with the vomiting centre to initiate vomiting. Lastly, direct stimulation of the gastrointestinal tract may also cause nausea and vomiting. Each of these methods sends impulses to the salivation centre, the respiratory centre and the pharyngeal, GI and abdominal muscles, ultimately leading to vomiting (Wilhelm et al., 2007).

Stimulation of the CTZ can also result from medication use, infection, toxins, sights, smells, memories, pain, and stimulation from the vestibular system. The vestibular system senses equilibrium based on the level of fluid in the inner ear. Disruption of this fluid may cause nausea and vomiting and is frequently related to imbalance and motion sickness (Sanders et al., 2007). These stimuli generate an impulse that travels from the CTZ directly to the vomiting centre. Gastrointestinal irritation may also be mechanical in nature; due to gastro-esophageal reflux, viral illness, food borne pathogens, allergies and over distension. GI irritation initiates anti-peristalsis which induces the movement of large amounts of food upwards for expulsion.

It is for the above reasons that Dimenhydrinate may not be useful in the treatment of nausea and vomiting related to chemotherapy medications. Chemotherapy drugs tend to stimulate the vomiting centre directly whereas Dimenhydrinate has the ability to suppress nausea and vomiting associated with stimulation of the chemoreceptor trigger zone, and more specifically the vestibular centre.

In addition to the above noted potential complications of vomiting, it is important to note that one complication may lead to another. For example, aspiration may lead to pneumonia, electrolyte imbalances may lead to metabolic acidosis and the forceful act of vomiting may lead to an esophageal tear (Mallory-Weiss Tear) or esophageal rupture (Boerhaave's Syndrome). Nausea alone isn't harmful; however excessive vomiting does have the potential to cause serious harm to the patient. It is therefore important to not only eliminate the feeling of nausea, but to prevent vomiting. The goal of antiemetic medications is to interfere with the impulse that is traveling to, and activating the vomiting centre (Cranwell-Bruce, 2009).

Pharmacology of Dimenhydrinate

Dimenhydrinate has both antihistamine and anticholinergic effects on the body resulting in its overall antiemetic properties. It is frequently used in the EMS setting and is also readily available as an over the counter medication for the treatment of nausea, vomiting and motion sickness (Carter & Ray, 2007). Its efficacy is significant in the vestibular system where there is a high concentration of histamine (H1) and muscarinic cholinergic receptor sites. As noted above, stimulation of the vestibular system activates the vomiting centre, therefore blockage or interruption of the receptor sites in the vestibular system prevents its stimulation (Wilhelm et al., 2007). It is therefore important to note that Dimenhydrinate is often ineffective in treating nausea and vomiting that is gastrointestinal in origin, or where the cause is due to direct stimulation of the vomiting centre (as is the case with chemotherapy medications).

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 administering Dimenhydrinate to a patient already taking narcotic medications. Potentiation occurs when two medications are taken together and the effects of one intensify the effects of the other. The effect of the narcotics in the example above may be exaggerated when administered with Dimenhydrinate. Synergism may also occur when administering two medications with similar actions on the body. If Dimenhydrinate and another anticholinergic were administered simultaneously, there is a chance that the combined effect would be greater than the effect of the two medications taken independently. It is for this reason that administering Dimenhydrinate to a patient having taken an overdose of antihistamines, anticholinergic meds or tricyclic antidepressants is strictly contraindicated. 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. For example, administering both a barbiturate and tranquilizer at the same time causes relaxation (one effect, as though only one medication had been administered). It is therefore very

important to exercise caution when administering any medication to any patient taking additional medications.

The most significant drawback to the use of Dimenhydrinate is the potential side effect of drowsiness (Kothari, Boyd, Bottcher & Lambert, 2000). This side effect, in addition to dry mouth and constipation must be clearly identified to patients receiving Dimenhydrinate in the pre-hospital setting (Wilhelm et al., 2007). Dimenhydrinate administration is by route of IM injection or IV access (for those certified) in the prehospital setting. When administered via IV access, Dimenhydrinate has the potential to burn or sting and is therefore diluted 1:9 in Normal Saline and administered slowly.

It is also very important to note that Dimenhydrinate should not be administered to anyone with a recent history of closed head injury or medical history of a seizure disorder. In patients with a recent closed head injury, Dimenhydrinate has the ability to further increase sedation in these patients which may lead to further complications. Dimenhydrinate has the ability to decrease the seizure threshold in those patients with a history of seizure disorders via paradoxical CNS stimulation (www.thomsonhc.com). Also note that the root cause of the nausea/vomiting in such a patient is usually unrelated to stimulation of the vomiting centre, and instead compression of the medulla. Paramedics must be aware not only of these potential complications, but also the mechanisms of pharmacology stated above. Refer to the current *Auxiliary Nausea & Vomiting Protocol (PCP & ACP)* for the appropriate management and treatment of patients suffering nausea/vomiting.

Summary

Nausea and vomiting are common complications associated with a variety of conditions and adversely affect a large population. It is important to note that while nausea and vomiting are necessary defense mechanisms against various toxins and irritants, when excessive, can lead to serious health complications. Nausea and vomiting are triggered by several centers in the brain what work synchronously with the muscles of the respiratory and digestive tract to induce vomiting when stimulated. In an attempt to reduce the discomfort associated with nausea and vomiting, Paramedics may administer Dimenhydrinate 50mg/mL either IM or IV according to the *Auxiliary Nausea & Vomiting Protocol (PCP & ACP).* Dimenhydrinate has antihistamine and anticholinergic effects and has the ability to alleviate the signs and symptoms associated with nausea and vomiting, however it is crucial to be aware of the complications associated with its administration and therefore the contraindications.

References

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