

## Dimenhydrinate For Nausea and Vomiting

### Vomiting

Vomiting is defined as the stomach's forceful evacuation of its contents through the mouth. It is an action taken by the upper gastrointestinal system in order to rid itself of its contents when it becomes irritated or over distended. The vomiting center lies within the medulla of the brain, and once stimulated, it sends motor impulses through the vagus nerve to the upper gastrointestinal system, and through the spinal nerves to the diaphragm and abdominal muscles. The result is forced expulsion of gastric contents.

In early stages of gastrointestinal irritation (mechanical irritation, GE reflux, viral illness, food-borne illness, food allergy) or over distention (over-eating, bowel obstruction) a process known as *antiperistalsis* begins. Antiperistalsis, commonly referred to as reverse peristalsis, is a wave of muscular activity that begins low in the GI tract and moves backward up the intestine at a rate of about 2-3 cm/ sec. This process can move a large amount of intestinal contents back to the stomach within 3-5 minutes. This gathering of contents causes further distention of the upper gastrointestinal system and contributes to further stimulate the vomiting reflex.

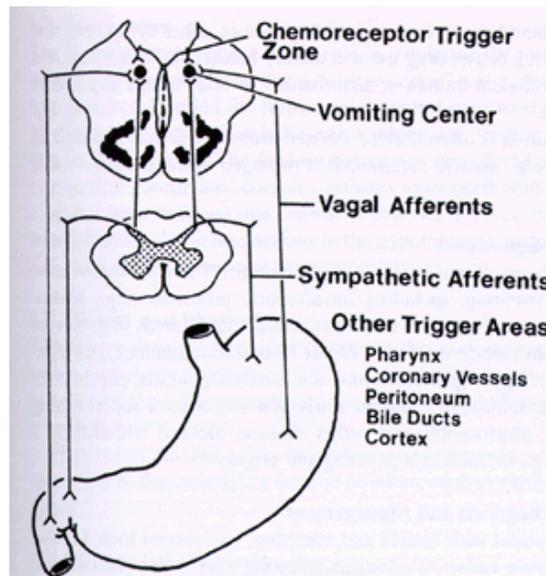
Vomiting can also occur by mechanisms other than direct gastrointestinal irritation. It can be caused by stimulation of an area in the brain known as the *chemoreceptor trigger zone (CTZ)*. Certain medications, infections, and toxins can stimulate this area, which in turn stimulates the vomiting center discussed above. Another common cause of nausea and vomiting is direct stimulation of the vomiting center by input from the inner ear or vestibular system (related to imbalance or motion sickness). Lastly, sights, smells, memory and/or pain can sometimes cause vomiting. The mechanism for this is direct input from the cerebral cortex to the vomiting center in the medulla.

Regardless of the cause, once the vomiting center has been sufficiently stimulated a chain of events occurs that leads to the act of vomiting:

1. A deep breath
2. Rising of the hyoid bone and larynx
3. Opening of the esophageal sphincter
4. Closing of the glottis to prevent aspiration
5. Lifting of the soft palate to close the nares
6. Strong diaphragmatic and simultaneous abdominal muscle contractions
7. Intragastric pressure rises and contents are expelled through the esophagus

## Effects of Vomiting

- Prolonged or forceful vomiting can lead to the following:
- Dehydration
- Aspiration
- Pneumonia
- Electrolyte imbalances
- Metabolic Alkalosis
- Esophageal tear (Mallory-Weiss tear) which causes upper GI bleeding
- Boerhaave's syndrome (rupture of the esophagus) which is potentially lethal



The vomiting center and chemoreceptor trigger zone control vomiting. Peripheral trigger areas send visceral afferent impulses, which stimulate the vomiting center into action.

## Nausea

Nausea is a psychogenic as well as physical feeling that often precludes vomiting. It defies an accurate definition, but is well known due to the fact that virtually everyone has experienced the sensation at some point. It is likely caused by the same stimuli that produce vomiting:

- Stimulation of the vomiting center due to gastrointestinal irritation
- Impulses that originate in the brain caused by drugs, motion, or memory which in turn stimulate the chemoreceptor trigger zone for vomiting

The act of vomiting occasionally occurs without the precursor of nausea. This indicates that only a portion of the vomiting center is stimulated with the sensation of nausea. While nausea itself is in no way harmful to a patient, its recognition may allow practitioners to intervene before the act of vomiting occurs.

# Dimenhydrinate

**Classification:** H1 Antihistamine, Anticholinergic, Antiemetic

**Alternative Name:** Gravol

## **How does it relieve Nausea and/or Vomiting?**

Dimenhydrinate has anticholinergic actions that act centrally at the chemoreceptor trigger zone (CTZ) to reduce nausea or vomiting.

This antiemetic action is unrelated to the actual blockade of histamine receptors, and it explains why Dimenhydrinate will not be useful in abolishing all forms of nausea or vomiting. For example, it may be ineffective against nausea or vomiting caused by gastrointestinal irritation. It is also not as useful as an antiemetic for patients receiving chemotherapy, as the drugs used for chemotherapy tend to stimulate the vomiting center directly where Dimenhydrinate is only useful in suppressing nausea and vomiting associated with stimulation of the chemoreceptor trigger zone. H1 antihistamines such as Dimenhydrinate are not always effective when receptor sites are already occupied by histamine. For this reason they have a weak ability to “knock” histamines off receptor sites. Early recognition of nausea by paramedics plays a significant role in the effectiveness of Dimenhydrinate.

## **Adverse Effects**

It is important to note that when we administer Dimenhydrinate for nausea and/ or vomiting the drug is not being used for its primary effect on the body, H1 histamine antagonism (antihistamine). Therefore there are many other effects of the drug that practitioners should expect. Histamine is responsible for many physiologic functions in the body. These include:

- Increased production of nasal and bronchial mucus
- Constriction of bronchial smooth muscle
- Constriction of intestinal smooth muscle
- Itching and pain in sensory nerve endings
- Increased myocardial contractility – Increased Inotropic effects
- Dilation and increased capillary permeability

When Dimenhydrinate (an antihistamine) is administered, all of these natural effects of histamine are blocked to some degree. The extent of the blockage will depend on the individual, as well as the dose administered. Practically speaking, the most common side effects of Dimenhydrinate administration include the following:

- Drowsiness
- Fatigue

- Blurred vision
- Tremors
- Vertigo
- Urinary retention

When administering Dimenhydrinate, or any other medication, practitioners must consider three principles of pharmacology.

- Potentialiation: Potentialiation occurs when two drugs are taken together and the effects of one drug intensify the effects of the other. For example, a patient who receives Gravol may experience exaggerated effects of narcotic medications such as morphine. As a result, less of the narcotic medication is required to achieve the desired effect.
- Synergism: Similar to potentialiation. When two drugs that have similar actions on the body are taken together ie) two anticholinergic medications, the combined effect is greater than the effect of the two drugs taken alone. This can be expressed as  $1+1 = 5$ . Alcohol consumption combined with sedative medications provides an example. Neither substance by itself is necessarily harmful, but together the effects are potentially dangerous.
- Additive Effect: Additive effect is the term used when two or more drugs are taken at the same time and the action of one plus the action of the other results in an action as if just one drug had been given. This could be represented by  $1+1= 2$ . An example would be a barbiturate and a tranquilizer given together before surgery to relax the patient.

Dimenhydrinate has both antihistamine and anticholinergic effects on the body. Caution must therefore be exercised when administering Gravol to a patient who is receiving medications with similar effects. The more common medications are listed below.

- Antihistamines: Benadryl, Chlortripalon, Atarax, Claritin, Seldane and Hismanal
- Anticholinergics: Atropine, Atrovent, Scopolamine and Tricyclic Antidepressant medications (Elavil, Amitriptyline, Imipramine, Clomipramine, Nortriptyline, Protriptyline, Doxepin, Desipramine)

## **Dimenhydrinate and Sedation**

Upon review of the enclosed protocol, you will notice that Gravol is not to be administered to a patient with a GCS of less than 13. This is due to the potential of the medication to induce sedation and CNS depression. The level of sedation is dependant upon many factors including patient's age, health, medication profile, and the dose administered. Therefore, when administering Gravol to patient populations who tend to have exaggerated effects (ie elderly, or patients with hepatic compromise), it is recommended that practitioners half dose (0.5 mg/kg) the patient. Extreme caution should also be exercised when administering Gravol to any patient with an altered LOA. It is also acceptable to round up or down to the closest 25 mg division. Rather than calculating an exact dose, administration would either be 25 mg or 50 mg total.

## Dimenhydrinate Administration

Dimenhydrinate may be administered via intramuscular injection (PCP or ACP), or intravenously (reserved for paramedics certified in IV initiation). The medication tends to sting or burn when administered via the intravenous route, thus for patient comfort the medication is diluted 1:9 prior to administration. It is also suggested that the medication be infused through a proximal port on the IV set to allow more time for dilution to occur prior to the medication reaching the patients tissue.

The following is the procedure for intravenous (IV) injection:

1. Establish IV and ensure stability of flow.
2. Using a 10 ml syringe, draw 9 ml of normal saline or sterile water into syringe (remember to cleanse injection site of vial).
3. Draw 50 mg of Gravol into syringe (**typically supplied as 50 mg in 1 ml**) and tap or gently shake to mix.
4. Clean proximal IV port with alcohol swab.
5. Insert syringe into cleansed IV port.
6. Occlude IV line proximal to injection site.
7. Advise patient medication might sting.
8. Administer appropriate dose as per protocol over 1 minute (concentration will be 50 mg in 10 ml or 5 mg/ml).

The following is the procedure for intramuscular (IM) injection:

1. Using an appropriate volume syringe, attach a minimum 1" needle.
2. Cleanse injection port of vial with alcohol swab.
3. Draw up the appropriate amount of contents of the vial into syringe.
4. Locate desired injection site (deltoid, gluteus, or thigh preferred).
5. Cleanse site with alcohol swab.
6. Advise patient that medication may sting.
7. Insert needle at a 90° angle (depth must ensure needle tip reaches muscle tissue).
8. Inject volume that corresponds to appropriate dose as per protocol.
9. Withdraw needle and dispose in sharps container.
10. Apply dressing and pressure or bandage if necessary for bleeding.
11. Massage injection site.

Note: The procedure lists above are intended to serve as reminders of the procedure of intramuscular and intravenous injections. Paramedics (both PCP and ACP) should have prior training in intramuscular injections. ACPs and PCPs, who are intravenous access certified, should have prior training in intravenous injections. Should you feel uncomfortable or unfamiliar with the appropriate procedure, please consult your local Base Hospital representative, and/or your local training department.

## **Example**

You are preparing to administer Dimenhydrinate to a 45 Kg female who has been vomiting for several hours. She is 70 years old, and you are concerned that being elderly, she may experience exaggerated sedation effects from the medication. As a result you decide to administer 0.5 mg/Kg. The procedure follows:

- 1) Inform the patient of your intentions to provide the medication.
  
- 2) Confirm the following:
  - ❑ Right Patient
  - ❑ Right Drug
  - ❑ Right Dose
  - ❑ Right Route
  - ❑ Right Time
  
- 3) Confirm patient does not have sensitivity to Dimenhydrinate.
  
- 4) Calculate dose to be administered as below:
  - ❑  $0.5 \text{ mg/Kg} \times 45 \text{ Kg} = 22.5 \text{ mg}$
  - ❑ Confirm concentration of Gravol (typically 50 mg/ ml)
  - ❑ Draw 1 ml of Gravol into 10 ml syringe
  - ❑ Draw 9 ml of normal saline into syringe (10mL total solution)
  - ❑ Note concentration is now 50 mg/ 10mL or 5 mg/ ml
  - ❑ Calculate volume to be delivered to patient (Dose/Concentration)
  - ❑  $22.5 \text{ mg} / 5 \text{ mg/ml} = 4.5 \text{ ml}$
  - ❑ Administer 4.5 ml of solution to patient following approved technique for administration.
  - ❑ It is acceptable to administer 25 mg (5 ml) to this patient.

## **Auxiliary Nausea and Vomiting Protocol (PCP & ACP)**

When the following conditions exist, a Paramedic may administer Dimenhydrinate (Gravol) IV or IM, according to the following protocol.

### **Indications**

Patient is experiencing extreme nausea, OR vomiting, OR motion sickness as a result of an underlying disease or prehospital administration of narcotics or other medications.

### **Contraindications**

#### **Absolute Contraindications**

1. Decreased level of consciousness (GCS<13)
2. Allergy to Dimenhydrinate (Gravol) or antihistamines
3. Overdose of antihistamines or any other anticholinergic medication or tricyclic antidepressants (TCA). **Contact BHP if unsure.**

#### **Relative Contraindications**

1. Closed head injury
2. History of Epilepsy or seizure disorder

### **Procedure:**

1. Administer 100% O2 and document vital signs.
2. Initiate continuous cardiac monitoring and pulse oximetry (if available).
3. Initiate IV NS TKO (if possible and certified).
4. Dilute Dimenhydrinate (Gravol) 1:9 with Normal Saline or sterile water prior to IV administration. If given IM do not dilute.
5. Advise the patient that the medication might sting.
6. Administer Dimenhydrinate (Gravol):
  - For patients < 40 kg, do not administer by protocol, contact BHP.
  - For patients > or = 40 kg, administer 0.5 – 1.0 mg/kg slow IV push or IM (if IV access not possible) to a maximum of 50 mg.
7. Monitor and document vital signs enroute to hospital.

### **References**

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