Prevention and Treatment of Motion Sickness

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Motion sickness is a common syndrome that occurs upon exposure to certain types of motion. It is thought to be caused by conflict between the vestibular, visual, and other proprioceptive systems. Although nausea is the hallmark symptom, it is often preceded by stomach awareness, malaise, drowsiness, and irritability. Early self-diagnosis should be emphasized, and patients should be counseled about behavioral and pharmacologic strategies to prevent motion sickness before traveling. Patients should learn to identify situations that will lead to motion sickness and minimize the amount of unpleasant motion they are exposed to by avoiding difficult conditions while traveling or by positioning themselves in the most stable part of the vehicle. Slow, intermittent exposure to the motion can reduce symptoms. Other behavioral strategies include watching the true visual horizon, steering the vehicle, tilting their head into turns, or lying down with their eyes closed. Patients should also attempt to reduce other sources of physical, mental, and emotional discomfort. Scopolamine is a first-line medication for prevention of motion sickness and should be administered transdermally several hours before the anticipated motion exposure. First-generation antihistamines, although sedating, are also effective. Nonsedating antihistamines, ondansetron, and ginger root are not effective in the prevention and treatment of motion sickness. (*Am Fam Physician*. 2014;90(1):41-46. Copyright © 2014 American Academy of Family Physicians.)

CME This clinical content conforms to AAFP criteria for continuing medical education (CME). See CME Quiz Questions on page 16.

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▶ **Patient information:** A handout on this topic, written by the authors of this article, is available at http://www.aafp.org/afp/2014/0701/p41-s1.html.

Motion sickness is a syndrome that occurs when a patient is exposed to certain types of motion and usually resolves soon after its cessation. It is a common response to motion stimuli during travel. Although nausea is a hallmark symptom, the syndrome includes symptoms ranging from vague malaise to completely incapacitating illness. These symptoms, which can affect the patient's recreation, employment, and personal safety, can occur within minutes of experiencing motion and can last for several hours after its cessation.

Nearly all persons will have symptoms in response to severe motion stimuli, and a history of motion sickness best predicts future symptoms.[1] Females, children two to 15 years of age, and persons with conditions associated with nausea (e.g., early pregnancy, migraines, vestibular syndromes) report increased susceptibility.

Etiology

The pathogenesis of motion sickness is not clearly understood, but it is thought to be related to conflict between the vestibular, visual, and other proprioceptive systems.[2] Rotary, vertical, and low-frequency motions produce more symptoms than linear, horizontal, and high-frequency motions.[1]

Clinical Presentation

Although nausea may be the first recognized symptom of motion sickness, it is almost always preceded by other subtle symptoms such as stomach awareness (i.e., a sensation of fullness in the epigastrium), malaise, drowsiness, and irritability. Failure to attribute early symptoms to motion sickness may lead to delays in diagnosis and treatment. Although mild symptoms are common, severely debilitating symptoms are rare[2] *(Table 1[1,2])*.

Behavioral Interventions

Prevention of motion sickness is more effective than treating symptoms after they have occurred. Therefore, patients should learn to identify situations that may lead to motion sickness and be able to initiate behavioral strategies to prevent or minimize symptoms[1,2] *(Table 2[1-13])*.

MINIMIZE VESTIBULAR MOTION

Patients should be advised to avoid traveling in difficult weather conditions. If they must

SORT: KEY RECOMMENDATIONS FOR PRACTICE

Clinical recommendation	*Evidence rating*	*References*
To prevent and reduce symptoms of motion sickness, passengers should look forward at a fixed point on the horizon and avoid close visual tasks.	C	2-5
To prevent and reduce symptoms of motion sickness in vehicles, passengers should actively steer, tilt their head into turns, recline, stabilize their head and body, or rest with their eyes closed.	C	6-8
Scopolamine should be a first-line medication for preventing motion sickness in persons who wish to maintain wakefulness during travel.	A	1, 2, 14, 15, 20, 21, 24
First-generation antihistamines are effective for preventing motion sickness, but often have sedative and other side effects.	B	1, 2, 16, 17, 19-21, 26

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to http://www.aafp.org/afpsort.

Table 1. Signs and Symptoms of Motion Sickness

Severity	*Signs*	*Symptoms*
Mild	Belching Yawning Facial and perioral pallor Heartburn Hypersalivation Urinary frequency	Stomach awareness Malaise Headache Irritability Drowsiness Fatigue
Moderate	Cold diaphoresis Flushing Increased body warmth Hyperventilation Vomiting	Nausea Nonvertiginous dizziness Apathy Depression Disinterest in social activities Disinclination for work Decreased cognitive performance Exaggerated sense of motion Increased postural sway
Severe	Inability to walk Incapacitation Loss of postural stability Persistent retching	Social isolation

NOTE: *Signs and symptoms are listed in decreasing order of prevalence.*

Information from references 1 and 2.

travel, they should sit in the part of the vehicle with the least amount of rotational and vertical motion.[2] This is usually the lowest level in trains and buses, close to water level and in the center of boats, and over the wing on airplanes.

HABITUATE TO MOTION

With continuous exposure to motion, symptoms of motion sickness will usually subside in one to two days. Alternatively, slow, intermittent habituation to motion is an effective strategy to reduce symptoms.[1] For example, spending the first night aboard a boat in the marina, followed by a day acclimating in the harbor, is preferable to going straight into the open ocean.

SYNCHRONIZE THE VISUAL SYSTEM WITH THE MOTION

A small study found that focusing on the true horizon (skyline) minimized symptoms of motion sickness.[5] A survey of 3,256 bus passengers suggested that forward vision was helpful in reducing symptoms.[3] Another study indicated that forward vision in a car can reduce symptoms.[4]

ACTIVELY SYNCHRONIZE THE BODY WITH THE MOTION

Actively steering the vehicle is an accepted strategy for reducing symptoms of motion sickness, although evidence is limited.[7] Additionally, a small study of automobile passengers found that actively tilting the head into turns was effective in preventing symptoms.[6] A survey of 260 cruise ship passengers supported the common advice to recline and passively stabilize themselves if they are unable to initiate active movements.[8]

REDUCE OTHER SOURCES OF PHYSICAL, MENTAL, AND EMOTIONAL DISCOMFORT

Frequent consumption of light, soft, bland, low-fat, and low-acid food can minimize symptoms of motion sickness.[2] Treating gastritis is useful,[2] as is avoiding nausea-inducing stimuli (e.g., alcohol, noxious odors). Discussing symptoms with others can exacerbate the condition. Passengers should be well rested, well hydrated, well fed,

Table 2. Behavioral Strategies to Prevent or Minimize Symptoms of Motion Sickness

General principle	*Tactics*
Minimize vestibular motion	**Avoid particularly noxious types of motions**
	Complex (multiple and off-axis) motions are worse than simple (one-axis) motions
	Low-frequency motions are worse than high-frequency motions
	Rotary motion is worse than linear motion
	Vertical motions are worse than horizontal motions
	Avoid travel in difficult conditions and locations
	Avoid air travel in storms and turbulent conditions
	Avoid terrain with many turns, accelerations, and ups and downs
	Avoid travel on water in storms and large waves
	Avoid travel through fog, clouds, and other conditions with poor visibility
	Choose location within the vehicle that minimizes motion
	Airplanes: over the wing
	Automobiles: driver's or front passenger seat, facing forward[3,4]
	Boats: facing toward the waves, away from the rocking bow, near the surface of the water[2]
	Buses: near the front, at the lowest level, facing forward[3]
	Trains: at the lowest level, facing forward
Habituate to motion	**Gradually increase amount of motion stimuli**
	Start travel in calm conditions and slowly increase the amount of motion exposure
	If symptomatic, attempt to reduce, but not eliminate, motion stimuli
Synchronize the visual system with the motion	**View the true visual horizon[2-5]**
	Avoid close work (e.g., reading, looking at computer screens, photography)
	Avoid spaces where the horizon cannot be seen
	Focus on a distant point on the horizon
	Look toward the motion or direction of travel
	Maintain a wide view of the horizon
	If unable to view the true visual horizon
	Close eyes and hold head still
	Wear sunglasses
Actively synchronize the body with the motion	**Perform active movements if possible**
	Actively tilt head into turns[6]
	Pilot the vehicle or connect with steering device[7]
	Stand with legs bent, and anticipate the motion by moving entire body
	Actively swim if in water
	Walk around the vehicle if possible
	If unable to perform active movements
	Brace body and head to avoid additional motion[8]
	Lay supine or recline head to 30 degrees
Reduce other sources of physical, mental, and emotional discomfort	**Treat and prevent gastritis[2]**
	Avoid alcoholic drinks
	Eat before traveling, and avoid an empty stomach
	Eat light, soft, bland, low-fat, and low-acid food
	Stay or get comfortable[2]
	Attempt to sleep
	Avoid dehydration, hunger, and fatigue
	Stay dry
	Avoid or reduce other unpleasant stimuli
	Assure adequate ventilation
	Avoid discussing motion sickness
	Avoid noxious stimuli (e.g., exhaust fumes, smell of emesis)
	Avoid unpleasant thoughts[9]
	Listen to music[10]
	Maintain a positive attitude[11,12]
	Use cognitive behavior therapy[2]
	Practice mindful breathing[13]

Information from references 1 through 13.

and comfortable before beginning travel. Small studies have shown that cognitive behavior therapy, mindful breathing, and listening to music may also reduce symptoms of motion sickness.[9,10,13]

Medications

Medications are most effective when taken prophylactically before traveling, or as soon as possible after the onset of symptoms[2] *(Table 3[1,2,14-23])*. Medications are most effective when combined with behavioral strategies. To familiarize themselves with common side effects, patients should first take medications in a comfortable environment before using them for motion sickness during travel.

SCOPOLAMINE

Scopolamine, an anticholinergic, is a first-line option for preventing motion sickness in persons who wish to maintain wakefulness

Table 3. Medications for Motion Sickness

Medication	*Effectiveness for prevention*	*Dosage*
Anticholinergic		
Scopolamine[14-16]	Transdermal: most effective	Transdermal: one patch applied to mastoid at least four hours before travel, then every 72 hours as needed
	Oral: moderately effective	Oral: 0.4 to 0.6 mg one hour before travel, then every eight hours as needed
Antihistamines (first-generation, listed from least to most sedating)		
Cinnarizine[15]	Moderately effective	Adults and children older than 12 years: 30 mg two hours before travel, then 15 mg every eight hours as needed
		Children five to 12 years of age: 15 mg two hours before travel, then 7.5 to 15 mg every eight hours as needed
Cyclizine (Marezine)[17]	Least effective	Adults and children older than 12 years: 50 mg one hour before travel, then every four to six hours as needed (maximum: 200 mg per day)
		Children six to 11 years of age: 25 mg one hour before travel, then every six to eight hours as needed (maximum: 75 mg per day)
Dimenhydrinate[16,18]	Least effective	Adults and children older than 12 years: 50 to 100 mg every four to six hours (maximum: 400 mg per day)
		Children six to 12 years of age: 25 to 50 mg every six to eight hours as needed (maximum: 150 mg per day)
Diphenhydramine	Least effective	Adults and children older than 12 years: 25 to 50 mg every four to six hours (maximum: 300 mg per day)
		Children six to 12 years of age: 12.5 to 25 mg every four to six hours as needed (maximum: 150 mg per day)
Promethazine[16,19]	Moderately effective	Adults: 25 mg 30 to 60 minutes before travel, then every 12 hours as needed
		Children: 12.5 to 25 mg twice daily as needed
Meclizine (Antivert)[16,18]	Least effective	Adults and children 12 years and older: 25 to 50 mg one hour before travel, then every 24 hours as needed
		Children younger than 12 years: not recommended

**—Most side effects are dose-related.*

Information from references 1, 2, and 14 through 23.

during travel.[2,20,24] A Cochrane review of 14 randomized controlled trials (RCTs) showed that scopolamine is effective for the prevention of motion sickness.[14] A more recent RCT of 76 naval crew members showed that transdermal scopolamine is more effective and has fewer side effects than the antihistamine cinnarizine (not available in the United States).[15] If the recommended dose of scopolamine does not adequately relieve symptoms, the dose may be doubled. Adding a second patch of transdermal scopolamine was well tolerated in a small RCT of 20 sailors.[25]

ANTIHISTAMINES

First-generation antihistamines have been used to treat motion sickness since the 1940s.[1] They are generally recommended for patients who can tolerate their sedative effects.[2,20] Cyclizine (Marezine), dimenhydrinate, promethazine, and meclizine (Antivert) demonstrated effectiveness in small RCTs of varying quality.[16-19] Nonsedating antihistamines are not effective in preventing or treating motion sickness.[26]

OTHER MEDICATIONS

Benzodiazepines are occasionally administered for severe symptoms of motion sickness and have been proven effective in a single small study.[27] The serotonin agonist rizatriptan (Maxalt) reduced motion sickness symptoms in a single RCT of 25 patients with recurrent migraines.[28] The serotonin antagonist ondansetron (Zofran) is ineffective for the prevention and treatment of motion sickness.[29,30]

Comments	Side effects*
First-line medication for prevention; transdermal formulation available by prescription; oral formulation not available in the United States; causes more dry eyes and dry mouth than antihistamines, but less sedation; may double dose or combine with antihistamines, or combine oral and transdermal formulations (increased risk of side effects); use with caution in older patients; not recommended for children younger than 10 years	Common: dry eyes, dry mouth, sensitivity to bright light Less common: blurred vision, dizziness, headache, sedation Uncommon: acute angle glaucoma, confusion, contact dermatitis, monocular pupillary dilation, urinary retention
Available over the counter in Mexico and Europe; not available in the United States or Canada; has calcium channel–blocking properties	**Class effects:** Very common: sedation Common: dry eyes, dry mouth Less common: blurred vision, sensitivity to bright light Uncommon: confusion, urinary retention
Available over the counter	
Available over the counter	
Oral formulations available over the counter; solution for intramuscular administration available by prescription	
Prescription only; also available as rectal suppositories and as solution for intramuscular injection	
Available over the counter	

COMPLEMENTARY AND ALTERNATIVE THERAPIES

Although ginger root is often reported to prevent motion sickness, it had no statistically significant effects in an RCT of 80 naval cadets.[31] A single RCT of pregnant women showed that stimulation of the P6 acupressure point on the anterior wrist increased their tolerance of motion stimuli.[32] Controlled trials of behavioral, pharmacologic, or alternative therapies for motion sickness have demonstrated strong placebo effects. Therefore, treatments are likely to be most effective if the patient believes that they will work.[11,12]

Data Sources: PubMed was searched using the MeSH headings motion sickness, ships, movement, space motion sickness, and travel. Additional searches were performed in Essential Evidence Plus, UpToDate, Medscape, and BMJ Clinical Evidence. Search dates: March 2012 through March 2014.

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