

Motion Sickness

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High-flying modern jets, stabilised passenger ships and broad, gently curving motorways have diminished the incidence of travel sickness. Many people however still dread global relocation, or dare not travel for fear of succumbing to the miseries of motion illness. They suffer in greater or lesser measure from a disabling malady and the consequences of an unstable environment. Anticipatory drug therapy can provide a measure of protection with manageable side effects but, the ideal anti-motion remedy is still awaited.

Motion sickness is a debilitating but relatively short-lived illness which indiscriminately affects air, land and sea travellers.¹ The malady attracted pro-found investigation, with the advent of cosmic travel and its attendant space sickness. It appears to have affected man through recorded time. It was well known to ancient Greek seafarers who referred to it as *nauxia* - sea-sickness - precursor of the English word *nausea*. Greek mythology records that the fair maiden Helle, flying home from her adventures on a golden ram, was affected by vertigo and fell into the sea -the Helles pont. Julius Caesar suffered grievously from the disease on his crossing of the Channel and the illustrious Lord Nelson had to fight sea-sickness before his battles.

Textbooks refer to travel sickness as a physiological vertigo and the autonomic symptoms are all too familiar to many. The onset follows a variable sequence of drowsiness, yawning, cold sweats, increased salivation and general malaise. Associated with epigastric discomfort, nausea and pallor, digestion is impaired and the sight or smell of food aggravates the condition, which continues to vomiting and varying degrees of apathy, depression and incapacity. Circulatory, respiratory and psychological disturbance are often apparent. Hyperventilation is common leading to hypocapnia and changes in blood volume, with pooling in the lower parts of the body with accompanying postural hypotension and syncope.

A Significant problem

It has proved to be a significant problem in manned-space flights. Despite much study there are still no good predictive tests of individual propensity to motion sickness and no perfect counter-measures - or therapies to counter its onset.

Signs and symptoms

Symptoms can be present in variable degree, may wax and wane, but develop over time and steadily worsen with exposure to environmental instability. New cases continue to appear after many hours, as unaccustomed motion continues. Characteristically, vomiting eases the symptoms temporarily, but persistent vomiting over several days of travel can often result in dehydration and electrolyte imbalance. Psychological components present as varying degrees of withdraw-al, apathy, or depression associated with functional incapacity.

There are reports of sickness occurring in passengers mounting the gangway of the ship, even before untoward effects of motion have been experienced.

With professional aviators and seamen a significant consideration is the adverse effect on performance. 60 to 80% of sailors in naval offshore patrol boats have been shown to suffer sea-sickness in rough weather, and many become unfit to continue conventional duties. Pilots on holding patterns in turbulent air conditions become airsick ,with possible hazardous effects on performance. Most airline company regulations preclude use of anti-motion medication.

The exact cause of motion sickness is still not understood but the illness arises from stimulation of the labyrinthine sense organs over a lengthy period in an intense manner to which the body is not accustomed. The condition only occurs in those with intact labyrinths. Visual sensory disturbance sickness suggests it is related to conflicting information in brain input from the visual and labyrinthine sensors which is then read in relation to a pattern of expected associations stored in the brain. The brain's failure to match perceived and received information results in conflict, dissonance and physiological disturbance.

Most observers consider that motion sickness is a normal response to an abnormal environment. One widely accepted hypothesis postulates that the brain stem mechanisms of orientation and motion may per-form an additional function other than maintenance of body equilibrium, stability of head and body, and gaze maintenance. This function detects and responds to certain poisons. With motion sickness, conflict in sensory inputs simulates poisoning of neu-romechanisms.¹

Some investigators believe that the emetic chemoreceptor trigger zone in the area postrema of the medulla oblongata is incriminated in producing motion ill-ness. It has been postulated that, due to motion a vomiting substance is secreted into the cerebrospinal fluid in the emetic process and that therapeutic measures should be directed at prevention of its secretion. Overall, evidence suggests that the area postrema is not essential for motion-induced vomiting and it is irrational to seek pharmacological blocking agents that act at the chemoreceptor trigger zone. It may be that an as yet unidentified neural element indispensable for motion-induced vomiting is located close to the area postrema. Identification of this feature and its neurochemical links could be the breakthrough required for an effective therapy for motion sickness.³

Habituation

A striking feature of motion sickness is individual ability to become accustomed to motion. Most people habituate to the adverse stimulus over time but the conditioning is lost when exposure is discontinued and re-exposure is delayed. Habituation is also related to the pattern of motion with travellers in large ships becoming ill on transferring to small ones whilst sailors can become air-sick when transferring to air-craft exposed to sustained turbulence. The change in ability to withstand the disturbing stimuli presumably includes a learning component with the individual adapting postural control and locomotor function to the moving environment.

Simulator machines are often used to test for propensity to motion sickness although there have been occasions when cosmonauts most resistant to rotational stimulation have succumbed markedly to space sickness in flight. Machines have shown that the frequency of up and down movement most likely to induce illness is one cycle in 16 seconds. Frequencies higher than one cycle per second produce little motion sickness. The study of autonomic response in motion sickness stimulation has shown increases in pulse rate, ventilation and vasoconstriction and provided data to support the supposition that motion illness can be categorised as a stress reaction.⁴

Prevention

Only deaf-mutes with non-functioning labyrinths are known to be immune to the malady. The use of stabilisers on large ships diminishes the incidence of the ailment. Assuming the horizontal position is a useful preventive measure as it removes vertical acceleration, a dominant component of the disturbance. Keeping the head fixed relative to the body, maintaining the eyes on the horizon and avoiding fixating on proximal moving stimuli is also useful in prevention. Involvement in physical work on board ship, but avoiding reading, is also helpful. Many of those who are car-sick as passengers will be aware that they can avoid succumbing to the illness by driving themselves. Stuffy atmospheres and smells of cooking and fuel oil are stimuli likely to induce vomiting and should also be avoided. Those who have suffered the trauma of travel sickness will testify to the need for an effective preventive or remedy.

Case History

The toughest and fittest can succumb and I recall an occasion when as medical officer I was accompanying a high climbing expedition of brawny mountaineers en route to the Himalayas. Engine problems had grounded the scheduled jet service to Nepal and we transferred to an ancient piston-driven aeroplane for the flight over the hump to Kathmandu. Turbulent air space over the foothills had the aircraft bouncing and pitching as it clawed its way to higher altitude and tough 'tigers of the tops' were soon devastated by air-sickness. Some were prostrated and once sun-tanned faces took on an unaccustomed pallor and several became green of visage as nausea and vomiting took their toll.

Drug therapy

Drug therapy can be prophylactic but there is a strong placebo effect with anti-motion therapy. Controlled studies have shown that up to 55 % of a group can benefit from appropriate drug provision but 45 % will benefit from placebo. Anti-motion drugs are not very effective in diminishing the symptoms once the condition is established. They can provide protection during the first few days of exposure to vestibular stimulation, and habituation usually progressively increases to provide protection after this initial period. The two most commonly used drug groups, the phenothiazines and antihistamines, act centrally. The phenothiazines act on the chemoreceptor trigger zone (CTZ) and vomiting centre, whereas the antihistamines act on the CTZ and the vestibular apparatus. All have anticholinergic side effects which may prove troublesome. These effects have to be weighed against the potential benefits to the patients if sea crossings or road journeys are short.⁵

Cinnarizine, cyclizine, dimenhydrinate, hyoscine, meclizine and promethazine are all in general use. In a double-blind Norwegian study comparing seven commonly used agents for prophylaxis of seasickness in over 1700 volunteer tourists, there was little material difference shown in the efficacy of the drugs.¹

Hyoscine has had a predominant place in therapy because of its efficacy but it has side effects. It causes a dry mouth and dilation of the pupils with resultant loss of visual acuity and it has often a 'drugging' effect which causes a relaxed state of mind and disinclination to incentive and activity. The latter is a disadvantage where immediate action and response is required. The drug only works for a short period of six to eight hours.

Antihistamines are popular although not as effective as hyoscine. They give longer protection for up to 24 hours but cause sedation as a side effect. This can be welcomed by the traveller confronting a tedious journey but is potentially hazardous for those involved in decision-making and transport control. There is no advantage in combining an antihistamine and hyoscine. Swallowed tablets require to be ingested an hour before exposure but some like 'Kwells' are absorbed quite rapidly when taken sublingually. The transdermal patch is stuck behind the ear and gives three days' protection which is usually sufficient to allow habituation to free the victim from the disease.

Hyoscine dosage is two 0.3mg of the hypo-bromide taken an hour before travel and followed up at intervals of eight hours to a limit of 2mg per 24 hours. This can give up to 90 per cent protection from vomiting

but combats the nausea to a lesser extent.

Promethazine (Phenergan) and cyclizine (marzine) are given in a dosage of 25 to 50mg in 24 hours and with a protection range of 40 to 70 % in those treated. The use of anti-motion drugs in civil and military flying has been resisted on the grounds that any medication or condition requiring medication is likely to diminish operational proficiency to a dangerous level. Preparatory work for space-flight travel suggested, however, that selected dosage and combinations of promethazine, scopolamine and d-amphetamine could be used in cosmonauts without loss of operational proficiency.³ I-Hyoscine (Scopolamine) has been considered for combatting motion sickness (Dahl 1984) especially for brief exposure, but has been of limited value orally and as an injection because of side effects. The antinauseant effect of scopolamine does not depend upon its peripheral parasympathetic blocking capacity but is caused by a central effect. Using the transdermal route of administration allows delivery of the drug in an effective concentration in a dosage low enough to avoid severe adverse reactions. The efficacy of transdermally administered scopolamine has been compared with the efficacy of dimen-hydrinate and placebo in a double-blind controlled studies. The patch afforded 61-67% protection against motion sickness at sea against 48-88% protection from dimenhydrinate. Dry mouth is the main side-effect reported for the patch occurring in around two-thirds of users. Temporary blurring of vision may also occur with the drug which is otherwise well tolerated in transdermal presentation. The patch also has the advantage that it can be removed if the need for protection becomes no longer paramount.

Treatment

Once the individual has succumbed to the illness, he or she should be encouraged to lie down, if possible, with eyes closed. The prostrated should be kept warm and given sips of water to avoid dehydration. The very ill over a longer period may require enteral or parenteral fluids. Despite the misery of the condition while it lasts, most people, on a longer journey, can expect substantial improvement over a day or two. A remarkable feature is the self limitation of effects and the rapidity of recovery once motion ceases.

Hyoscine is an effective preventive medication for which oral preparations and transdermal patches are established in clinical practice, and emerging evidence suggests that hyoscine nasal spray is effective in pre-venting motion sickness

Evidence to support the use of other drugs, taking into account the trade off between efficacy and adverse effects, is weaker.⁶

Management of motion sickness with traditional remedies such as ginger and acupressure bands has not been shown to be effective.

Advice for travellers

Sea travel

Apply a scopaderm transdermal patch three to four hours before starting voyage. Keep in the fresh air as much as possible.

Fix the eyes on the horizon.

Keep the head fixed in relation to the body.

Lie down if symptoms seem imminent with the head towards the centre of rotation and close eyes.

Seek a mid-decks, midships cabin.

Car-sickness

A short-acting preventive may suffice but must be taken one hour before travel. Use a head-rest to fix the head position.

Use fresh-air vents to avoid a hot, stuffy atmosphere.

Fix eyes on the distant view, or keep them closed. Avoid reading when travelling.

Air-sickness

Long flights merit the use of the scopaderm patch applied before arrival at the airport or antihistamine medication.

Avoid ingesting alcohol, and eat little.

Keep the head fixed against the headrest.

The new Boeing Dreamliner has technology in the seats which senses and counteracts turbulence, and Boeing predict an eightfold reduction in the number of passengers experiencing motion sickness.

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