Sopite Syndrome Identified in a Student Naval Aviator

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BACKGROUND: Sopite syndrome is a poorly understood symptom complex characterized by drowsiness and lethargy relating to motion sickness. Though often occurring in conjunction with the classic symptomatology of motion sickness, the literature suggests that sopite syndrome is a separate entity that may occur independently of the feelings of nausea characteristic of traditional motion sickness. Additionally, the syndrome can last long after symptoms of nausea have subsided and can be debilitating to some patients. Due to the frequent concomitance of sopite syndrome and the classic symptoms of motion sickness, the syndrome may frequently go unidentified and there is a paucity of data recording its exact incidence in the available literature.

CASE REPORT: In this study, we report a case of sopite syndrome identified in a 23-yr-old student naval aviator who was ultimately unable to overcome his symptoms and adapt to the dynamic environment of flight.

DISCUSSION: This process is particularly relevant to student aviators and others involved in transportation settings where the existence of even mild performance challenges may create the potential for operational hazards. Because the training of aviators and flight officers is historically one of the most expensive investments undertaken by the Department of the Navy each year, documenting unique manifestations of this common problem and addressing them early in the training pipeline may help reduce the time and financial burden associated with student naval aviator attrition in the later stages of training.

KEYWORDS: naval aviation, airsickness, Bárány chair, habituation.

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"Ernsting's Aviation and Space Medicine" text describes motion sickness as "a condition characterized primarily by nausea, vomiting, pallor, and cold sweating that occurs when a person is exposed to certain types of real or visually implied motion."[18] The term encompasses seasickness,[12] airsickness,[6,12] carsickness,[5] sickness experienced within rotating rooms,[6,12] simulator-sickness within optokinetic drums,[9] virtual-reality-sickness,[12] and space-sickness.[10] Drowsiness, lethargy, and somnolence are important, though often ignored symptoms associated with motion and can remain in effect even after the cessation of exposure to motion stimulus.[6,12,16,18] Though the sleep inducing effects of repetitive motion stimulus on infants has long been recognized, Graybiel and Knepton did not first explicitly define "sopite syndrome" until 1976.[6,12,18] Their seminal paper described the syndrome as a process centering on drowsiness and lethargy that can sometimes be the "sole manifestation of motion sickness."[6] Further revisions to the precise definition have since been suggested to address shortcomings of previous definitions, including nonspecificity of soporific symptoms, the health state of the individuals, and to clarify that the syndrome, as with motion sickness generally, can be observed in both real and simulated motion settings.[9,15] Further research has provided evidence that 'yawning' may be an additionally viable behavior marker to recognize the onset of soporific symptoms and their concomitant reduction in cognitive performance.[14] Matsangas and McCauley have further refined the description of sopite syndrome and suggested the most current definition as "a symptom complex that develops as a result of exposure to real or apparent motion and is characterized by excessive drowsiness, lassitude, lethargy, mild depression, and reduced ability to focus on an assigned task."[15] They further characterized the syndrome as being "most clearly distinguished in a healthy individual free from pathological conditions that engender similar symptoms

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and not suffering from sleep deprivation, mental or physical fatigue, or increased levels of physical activity."[15]

The sensory conflict or neural mismatch hypothesis is widely accepted as responsible for the symptoms of classic motion sickness.[18,21] According to this hypothesis, symptoms of motion sickness result from a mismatch and subsequent reweighing of sensory input into the brain's spatial integration center as it compares discordant information arriving simultaneously from the vestibular, visual, and proprioceptive systems.[18,21] Though the etiology of sopite syndrome is less well documented in the literature, some have implicated inhibition of noradrenergic neurons in the locus cerulus in developing the syndrome.[17]

A variety of questionnaires have been developed to aid in assessing symptoms of motion sickness and sopite syndrome. Research done by Lawson et al.[11] produced a Mild Motion Questionnaire designed as a trait scale to determine whether consistent symptoms used to describe sopite syndrome could be observed. Their research yielded an internally consistent scale of 39 items, which were broken up into 4 factors provisionally called head/body symptoms (e.g., stomach awareness), relaxed/content, drowsy/fatigued, and poor concentration/motivation (e.g., fuzz/foggy headed, lazy/unmotivated).[2,7,11] The construct validity of the Mild Motion Questionnaire was further tested by Wallace et al., distinguishing the symptomology of sopite syndrome from that of boredom or inattention.[22] Another assessment tool, the Motion Sickness Assessment Questionnaire, developed by Gianaros et al.,[4] allowed for the assessment of multiple dimensions of motion sickness. The four dimensions incorporated in the Motion Sickness Assessment Questionnaire were termed gastrointestinal (e.g., "I felt sick to my stomach"), central (e.g., "I felt dizzy"), peripheral (e.g., "I felt sweaty"), and sopite related (e.g., "I felt drowsy"). Subjects are asked to assign a severity value from 1–9 to 16 symptomatic complaints, each pertaining to one of the four aforementioned dimensions.[4,7] Less recently developed questionnaires used to assess motion sickness include the Pensacola Diagnostic Index (1968), a peer evaluation questionnaire (1975), and the Pensacola Motion Sickness Questionnaire (1965).[4]

Pharmacological as well as nonpharmacological treatment options exist for the treatment of motion sickness. Pharmacological alternatives typically consist of an antihistamine (e.g., promethazine, diphenhydramine) or the anticholinergic drug scopolamine.[18,21] Because these medications are central depressants, they are often combined with adrenergic agonists, including dextroamphetamine or ephedrine or other stimulants like modafinil or caffeine, to mitigate symptoms of drowsiness.[18,21] It is important to note that the addition of an adrenergic agonist stimulant has been found to create a synergistic increase in the prophylactic potency of antimotion sickness medications in addition to mitigating symptoms of drowsiness.[18,21] Pharmacological alternatives for sopite syndrome have been less researched, although intramuscular ephedrine has been shown to demonstrate effectiveness in treating drowsiness after the soporific symptoms have already been established.[23] Nonpharmacological treatments to motion sickness center on habituation and desensitizing the patient to the mismatched sensory input. Therapy involving repeated cross-coupled (Coriolis) stimulation that is incrementally increased in intensity over a period of weeks has been shown to aid significantly in resolving many symptoms associated with motion sickness, with a study by Lucertini et al.[13] citing success rates to be as high as 85%.[13,18,21] Optokinetic training has additionally been shown to be of benefit in the treatment of seasickness in sailors with success rates of over 70% reported in the literature.[19]

CASE REPORT

A 23-yr-old man with no significant past medical history presented following multiple episodes of active (nausea with emesis) and passive (nausea without emesis) airsickness while training in the T-6B fixed wing primary training aircraft. His first experience with these symptoms occurred while flying in the relatively stable and nonaerobatic Cessna aircraft during the Introduction to Flight School course required as early training for student naval aviators. The symptoms resurfaced approximately 6 mo later once he began flying in the much more aerobatic and dynamic T-6B aircraft as a part of Primary School training. In addition to his symptoms of nausea, the student reported feelings of extreme fatigue that he described as "knowing it won't take long to fall asleep." His symptoms were so profound that he expressed a fear that he would have fallen asleep should his instructor have taken control of the aircraft during one of his training flights. The student reported modest, though inconsistent, improvement with dimenhydrinate (Dramamine) and ultimately sought further treatment through habituation via cross-coupled (Coriolis) stimulation with an aviation physiologist. The cross-coupled stimulation was conducted using a motorized Bárány chair to achieve 11–24 rotations per minute. The student was spun for a total of seven sessions on successive days with incrementally increasing rotational velocity on each day. Each session consisted of two separate 10-min periods with a 10-min break between spins. During each spin, the patient conducted a series of head movements to induce nausea, in an attempt to create habituation and allow for the development of mitigation techniques. The patient was unable to complete the first two spin sessions due to passive motion sickness. On subsequent sessions he expressed symptoms of tiredness and explained he had difficulty staying awake in addition to symptoms of nausea. By the final two spin sessions, the patient was able to complete the exercise without feelings of passive motion sickness, but not without recurrent symptoms of extreme fatigue and difficulty staying awake that lasted the entirety of the sessions. Ultimately the patient was unable to overcome his soporific symptoms and motion sickness, necessitating his attrition as a naval aviator candidate.

DISCUSSION

It is difficult to overstate the clinical and operational relevance of understanding the symptomatology and therapies for motion sickness. The training of naval aviators and naval flight officers is historically one of the most expensive investments undertaken by the Department of the Navy each year.[3,20] There is a high incidence of motion sickness experienced by student naval aviators in the initial phases of their training and these symptoms may be responsible for a significant portion of student attrition.[3] Literature suggests that over 70% of student naval aviators experience some degree of motion sickness during training and a 2008 report cited motion sickness to be a "significant" or "very strong" factor in as many as 11% of attrited student naval aviator and student naval flight officers.[1,8] According to the July 2013 OPNAV 98 report prepared by the Chief of Naval Aviation Training comptroller, the total cost for training a student naval aviator through primary school is approximately $143,506.00, including an estimated $1090.36 per flight hour in the T-6B aircraft. Documenting unique manifestations of this common problem and addressing them early in the training pipeline may help reduce the time and financial burden associated with student naval aviator attrition in the later stages of training.

This case report serves to document the symptoms and training progression of one such naval aviator candidate whose condition was not adequately identified early on in his training. This case is particularly educational as it demonstrates an instance of sopite syndrome as existing independently of the symptoms classically associated with motion sickness. It is important to be aware of these often less recognized symptoms in an effort to reduce attrition rates, particularly during periods of military downsizing and budgetary constraints. Further research into the cost of current attrition rates from primary school due to airsickness may reveal the financial burden to be sufficiently high as to warrant further testing during the early stages of student naval aviator training. The implementation of habituation via cross-coupled stimulation using a motorized Bárány chair during the Introduction to Flight School course may prove to be a cost effective way of identifying refractory cases of sopite syndrome and airsickness and of alleviating some of the financial burden associated with attrition during the later stages of training.

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