TECHNICAL PAPERS

The Prevention and Treatment of Motion Sickness I. Seasickness[1]

Leslie N. Gay and Paul E. Carliner[2]

Allergy Clinic, Medical Department, Johns Hopkins Hospital and University, Baltimore

During the year 1947, Dramamine (β-dimethylaminoethyl benzohydryl ether 8-chlorotheophyllinate) was sent by the manufacturer to the Allergy Clinic of the Johns Hopkins University and Hospital for experimental investigation of its value in the control of the symptoms of hay fever and urticaria. The drug was administered to a pregnant woman who complained of urticaria and who incidentally has suffered all her life from car sickness. Unexpectedly, the car sickness was relieved as well as the urticaria. It was possible to control the car sickness of this patient at will. A placebo failed repeatedly, but the drug Dramamine gave her complete relief if she took 50 mg a few minutes before she boarded the streetcar.

A study of seasickness was planned and executed on the U. S. A. T. "General Ballou." This transport carried 1,366 soldiers to Bremerhaven, Germany. The voyage began on November 27, 1948 and, after a rough passage, terminated on December 7, 1948. Complete cooperation was given by the Surgeon General's office and by the Transport Command. Four adjacent compartments on the transport were set aside for the controlled study of the 485 men who were assigned to them and subjected to the same motion of the sea. Treatment was planned so that half the men were given Dramamine or a placebo of lactose at the time of departure from New York Harbor; the other half were given Dramamine or a placebo 2–12 hr after the onset of symptoms of seasickness. Adequate control groups were given a placebo. The dose of Dramamine was 100 mg every 5 hr and before retiring. Dramamine prevented seasickness in all but two of the 134 men who occupied compartment 3-E; a placebo failed to relieve the symptoms in all controls who developed true seasickness in compartment 3-F. However, the control group (34 men) obtained complete relief of symptoms within 1 hr after the first dose of Dramamine was administered. The drug gave complete relief to 14 men in compartment 4-E who developed symptoms 3 hr or more after the transport left New York. A placebo failed to relieve 14 men in compartment 4-F, but these men obtained complete relief ½ hr after Dramamine was substituted for a placebo. Nineteen men who developed symptoms (nausea and dizziness) 3 hr or more after the transport left New York were relieved by a placebo. These men required no medication during the last seven days of the voyage to Bremerhaven. Among 881 men who occupied other compartments on the transport, 195 cases of severe seasickness developed. Of these, 187 derived complete relief ½ hr after the administration of Dramamine. Relapses were induced by the substitution of a placebo, but these symptoms were relieved within ½ hr after the administration of Dramamine. During a period of 10 days, Dramamine was given to 389 cases of seasickness. Of this number, 372 were completely relieved of symptoms within 1 hr after the first dose of 100 mg. Seventeen cases derived only partial or no relief. A dose of 100 mg prescribed every 5 hr and before retiring was adequate to control the most distressing symptoms. When the patient was unable to retain a capsule administered orally, he did retain and absorb the drug given rectally. The benefit derived by this method was as rapid and as complete as that derived by the oral method. No reaction to Dramamine was encountered by any soldier to whom it was administered during the period of 10 days.

[1] This investigation was made possible by the Chief of Staff and the Surgeon General of the United States Army.

[2] The authors wish to express their appreciation to the Transport Command, especially Major C. W. Hodges, Lt. J. L. Soelling, and the nurses of the U. S. A. T. "General Ballou"; and to G. D. Searle & Co., of Chicago, who prepared the Dramamine and the placebo for the investigation.

The Effectiveness of Dramamine in the Prevention of Airsickness

Benjamin A. Strickland, Jr., and George L. Hahn

USAF School of Aviation Medicine, Randolph Field, Texas

The recent report by Gay and Carliner (*2*) on the effect of the new antihistaminic drug, Dramamine (β-dimethylaminoethyl benzohydryl ether 8-chlorotheophyllinate), as a preventive and treatment for seasickness has attracted widespread attention. Investigations on motion sickness in the past have shown a paucity of controlled studies carried out on shipboard or on aircraft. The methodology utilized by Gay and Carliner is strikingly provocative in that practical studies on motion sickness under actual precipitating conditions were subjected to controlled scientific scrutiny.

Armstrong (*1*) has pointed out the dearth of comprehensive reports in the literature on the subject of motion sickness caused by aircraft in flight. This form of motion sickness is well known and is encountered often enough to be considered a major problem of aviation medicine. Air sickness is one of the most frequent

causes of distress among airline passengers. In military aviation an appreciable number of flying cadets are eliminated for this reason; it is not unusual for combat aircrews to be affected; and not infrequently a high percentage of airborne troops and paratroopers are more or less incapacitated by the time they have reached their destination.

Smith (*3*) in 1946 reviewed all of the previous work aimed at finding a motion sickness remedy and recommended that until a better drug was available hyoscine hydrobromide be used in the prevention of airsickness in Air Force personnel. The reported remarkable effectiveness of Dramamine (*2*) in the prevention and treatment of seasickness would indicate that this drug might also be valuable in airsickness and in February 1949 the Air Surgeon authorized the USAF School of Aviation Medicine, Randolph Air Force Base, Randolph Field, Texas, to initiate tests.

A preliminary controlled study has been completed. A procedure was devised whereby one-hour flights simulating flight through turbulent air in a C-47 (DC-3) airplane were utilized. Volunteers were obtained from among individuals stationed at Randolph Air Force Base who were not on flying duty. No other selection factors were utilized within this group since it was desired to have as a test group a cross-section of young adult males who had not become conditioned or adapted to aircraft motion. In view of this it can be considered that the individuals studied are similar to those studied by Gay and Carliner.

Twelve flights of 18 individuals each have been carried out to date. On each flight conditions encountered in flying through gentle and moderately turbulent air were simulated. All variable factors were either controlled or "randomized." Methodology was as follows:

(a) Each group of 18 men on a flight was subdivided into a group of nine who received a 100-mg tablet of Dramamine and another nine who received a placebo identical in appearance. Care was taken to prevent each individual from knowing whether he received drug or placebo.

(b) The drug or the placebo was administered concurrently from 25 to 45 min before each flight.

(c) Seating arrangement in the airplane was carefully controlled in that an equal number of individuals who received the drug were distributed symmetrically in the forepart and the afterpart of the cabin. The same procedure was used in seating the individuals who received the placebo. In addition, drug and placebo subjects were symmetrically distributed on the right and left sides of the cabin.

(d) All flights were made at an altitude of 5,000 feet above mean sea level. The pilots had previously developed methods of simulating flight through gentle and moderately turbulent air. These maneuvers may be summarized as follows: (1) Yawing or "fish-tailing"—produced by moving the rudder from side to side. (2) Rolling—produced by raising and lowering the wings alternately by the aileron controls. (3) Pitching (including ascending)—produced by moving the elevators causing up-and-down motion. Minor altitude variations were obtained similar to those caused by updrafts and downdrafts. (4) Various combinations of the foregoing maneuvers were used and approximately three-fourths of the duration of each flight was devoted to intermittent simulation of flight through turbulent air.

(e) As in previous studies carried out on motion sickness at the School of Aviation Medicine, the incidence of airsickness in the subjects was judged on a purely objective basis, i.e., whether or not vomiting occurred.

Twelve flights were made under the conditions described and a total of 216 subjects were tested. One-half of the subjects received Dramamine and the other half a placebo. The results are shown in Table 1.

TABLE 1

Preflight medication	Airsick		Not sick		Total number
	Number	Percentage	Number	Percentage	
Dramamine ..	31	28.7	77	71.3	108
Placebo	60	55.6	48	44.4	108

Under the conditions described above 28.7 percent of those given Dramamine became ill as opposed to 55.6 percent among those given a placebo. Application of the statistical technique known as sequential analysis to the results shown in Table 1 indicates that additional experimental flights as described above would result merely in further verification of the same relative difference of incidence of airsickness.

So important is the solution of the problem of motion sickness in both commercial and military aviation that any drug or type of drug which appears to have significant effects in preventing airsickness warrants extensive investigation. Although the results of this experimental study are not spectacular, Dramamine appears to decrease the incidence of airsickness. More exhaustive studies under actual turbulent conditions are indicated. Additional research is presently under way at the USAF School of Aviation Medicine concerning the mechanism of action of Dramamine and other drugs in the prevention and treatment of airsickness.

References

1. ARMSTRONG, HARRY G. *Principles and practice of aviation medicine,* (2nd ed.) Baltimore: Williams and Wilkins, 1943.
2. GAY, LESLIE N., and CARLINER, PAUL E. "The Prevention and Treatment of Motion Sickness, I—Seasickness." Presented before the meeting of the Johns Hopkins Medical Society, Feb. 1949.
3. SMITH, PAUL K. "Present Status of Drugs for Use in Motion Sickness with Particular Reference to Airsickness." USAF School of Aviation Medicine Research Project 468, report No. 1, June 14, 1946.